

INTERIM RECORD OF DECISION

OPERABLE UNIT 3

RUBY GULCH WASTE ROCK DUMP

GILT EDGE MINE NPL SITE

LAWRENCE COUNTY,

SOUTH DAKOTA

August 2001

U.S. Environmental Protection Agency
999 18th Street, Suite 500
Denver, Colorado 80202

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LAWRENCE COUNTY, SOUTH DAKOTA

The U.S. Environmental Protection Agency (EPA), with the concurrence of the South Dakota Department of Environment and Natural Resources (SDDENR), presents this Interim Record of Decision (ROD) for the Ruby Gulch Waste Rock Dump Operable Unit (OU) 3 of the Gilt Edge Mine NPL Site, Lawrence County, South Dakota. The ROD is based on the Administrative Record for Ruby Gulch Waste Rock Dump (OU3), including the Hazard Ranking Scoring package, EPA/Bureau of Reclamation (BOR) Conceptual Closure Plan, the Proposed Plan, the public comments received, and responses by EPA and SDDENR. The ROD presents a brief summary of current site conditions, potential risks to human health and the environment, and the Selected Remedy. EPA followed the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, the National Contingency Plan (NCP), and EPA guidance (EPA, 1999) in preparation of the ROD. The three purposes of the ROD are to:

1. Certify that the remedy selection process was carried out in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. 9601 *et seq.*, as amended by the Superfund Amendments and Reauthorization Act (collectively, CERCLA), and, to the extent practicable, the NCP;
2. Outline the engineering components and remediation requirements of the Selected Remedy; and
3. Provide the public with a consolidated source of information about the history, characteristics, and risk posed by the present operation of the Ruby Gulch Waste Rock Dump (OU3), as well as the rationale behind the Selected Remedy, and the agencies consideration of, and responses to, the comments received.

The ROD is organized into three distinct sections:

1. The **Declaration** section functions as an abstract and data certification sheet for the key information contained in the ROD and is the section of the ROD signed by the EPA Regional Administrator.
2. The **Decision Summary** section provides an overview of the OU3 characteristics, the alternatives evaluated, and the analysis of those options. The Decision Summary also identifies the Selected Remedy and explains how the remedy fulfills statutory and regulatory requirements; and
3. The **Responsiveness Summary** section addresses public comments received on the Proposed Plan and other information in the Administrative Record.

Part 1

The Declaration

1.1 Site Name and Location

The Gilt Edge Mine NPL Site (EPA ID No. SDD987673985) is located southeast of the town of Lead in the northern Black Hills in Lawrence County, South Dakota. Specifically, the site is in parts of Sections 4, 5, 6, 7, 8 and 9, T. 4 N., R. 4 E. of the Deadwood South Quadrangle, Lawrence County, South Dakota (U. S. Geological Survey 1971).

EPA has organized the site management and remedial response activities into three operable units:

Operable Unit 1:	Site-Wide Gilt Edge Mine
Operable Unit 2:	Interim Water Treatment
Operable Unit 3:	Ruby Gulch Waste Rock Dump

1.2 Statement of Basis and Purpose

This decision document presents the Selected Remedy for an interim response action at the Gilt Edge Mine Operable Unit (OU) 3, Ruby Gulch Waste Rock Dump in South Dakota. The Selected Remedy was chosen in accordance with CERCLA, as amended by SARA, and to the extent practicable, the NCP. South Dakota concurs with the Selected Remedy.

1.3 Assessment of the Site

The response action selected in this Interim Record of Decision (ROD) is necessary to protect the public health or welfare and the environment from actual or threatened releases of hazardous substances into the environment.

1.4 Description of the Selected Remedy

Operable Unit 3, the subject of this Interim ROD, addresses contamination associated with the largest ARD source on the site, the Ruby Gulch Waste Rock Dump (Ruby Dump). ARD generating from the sulfide materials of the Ruby Dump, if not reduced and contained, poses a major threat of erosion, contamination, and flows into the Ruby Gulch drainage and Bear Butte Creek. This Interim ROD addresses this threat by reducing the volume of contaminated materials exposed at OU3, reducing infiltration that produces large quantities of ARD, and containing the materials of the Ruby Dump. EPA completed a Focused Feasibility Study for

the dump cap in March 2001. This Interim ROD will be consistent with and will not preclude implementation of the final remedy(ies) at the Site.

The remedy selected by EPA and SDDENR for this interim remedial action is:

- regrading of waste rock, including placement in the upper Ruby Gulch drainage;
- construction of a composite cap using a geomembrane liner;
- installation of lateral drainage structures to limit erosion and convey runoff;
- construction of a protective layer for the liner and surface water controls using materials consisting of the Highway 385 project rock and growth materials from onsite sources; and,
- construction of surface water run-on diversion channels.

The purpose of the selected remedy for this interim action is to: (1) control erosion of mine waste into local water courses; (2) control formation of acid rock drainage (ARD) and leaching and migration of contaminants from mine waste into surface water, (3) control formation of ARD and leaching and migration of contaminants from mine waste into local groundwater, (4) significantly reduce the quantity of acidic and metal-laden ARD requiring containment and treatment, and (5) thereby reduce the threat of release to downgradient water users.

1.5 Statutory Determinations

The Selected Remedy (1) is protective of human health and the environment, (2) complies with those federal and state requirements that are applicable or relevant and appropriate for this limited-scope response action, and (3) is cost effective.

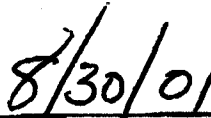
1.6 ROD Data Certification Checklist

The following information is included in the Decision Summary section of this ROD. Additional information can be found in the Administration Record file for this site.

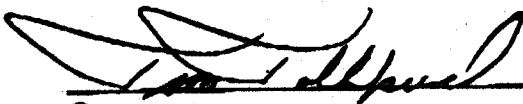
- Chemicals of concern and their respective concentrations.
- Baseline risk represented by the chemicals of concern.
- How contaminated waters constituting principle threats are addressed.
- Estimated capital and operation and maintenance (O&M) costs are presented.
- Key factor(s) that led to selecting the interim response action (i.e. describe how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision).



Max H. Dodson
Assistant Regional Administrator
Ecosystems Protection and Remediation
U.S. Environmental Protection Agency, Region VIII

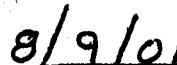


Date



Concurrence:

Tim Tollefsrud, Director
Division of Environmental Services
South Dakota Department of Environment and Natural Resources



Date

Part 2

Decision Summary

2.1 Site Name, Location, and Description

The Gilt Edge Mine NPL Site (Environmental Protection Agency [EPA] ID No. SDD987673985) is located southeast of the town of Lead in the northern Black Hills in Lawrence County, South Dakota. Specifically, the site is in parts of Sections 4, 5, 6, 7, 8 and 9, T. 4 N., R. 4 E. of the Deadwood South Quadrangle, Lawrence County, South Dakota (U. S. Geological Survey 1971). The lead agency for the site is the EPA with support from the South Dakota Department of Environmental and Natural Resources (SDDENR). The source of response funds for this site is expected to be the Superfund trust fund, with South Dakota providing ten percent of the cleanup costs as required by CERCLA.

The Gilt Edge Mine is an abandoned 258-acre open pit, former cyanide heap leach gold mine, developed in highly sulfidic rock. The area has been mined intermittently by several owners beginning in the late 1800s. Cyanide leaching, mercury amalgamation, and zinc precipitation among other methods were used to recover gold. Placement of the Gilt Edge Mine site on the National Priorities List (NPL) is based on releases of cadmium, cobalt, copper, manganese, lead and zinc that have been documented in Strawberry Creek, a tributary to Bear Butte Creek, and Bear Butte Creek. Strawberry Creek and Bear Butte Creek are classified by the State of South Dakota as

- cold water marginal (Strawberry Creek) and cold water permanent (Bear Butte Creek) fish life propagation waters;
- limited-contact recreation waters,
- fish and wildlife propagation, recreation, and stock watering waters, and
- irrigation waters.

2.2 Site History and Enforcement Activities

2.2.1 Site History

Mining activities began at the site in 1876 when the Gilt Edge and Dakota Maid claims were located. Historical underground mining operations extracted sulfide-bearing gold ores from irregular deposits in veins and fracture zones in the igneous rocks.

The property of the Gilt Edge Mines, Inc. is a consolidation of claims including the Sunday, Rattlesnake Jack, Gilt Edge, Dakota Maid, Oro Fino groups, and others. The property has had a number of owners and operators over the past century (BOR 2000). The Oro Fino Mine was the first mine in the area, and it began and ended operations in 1893. No mining was conducted again until 1900. The Hoodoo-Union Hill group of mines was located adjacent to the Gilt Edge group. The Hoodoo-Union Hill group was active around 1900. The Anchor Mountain mine was

also historically active in 1900. The original Gilt Edge Mining Company operated from 1900 to 1902. No mining was conducted between 1902 and 1905. The Gilt Edge-Maid Gold Mining Company operated from 1905 to 1916. Production of gold and silver, and small amounts of copper, lead, and zinc are reported from the properties at Gilt Edge. Mining continued sporadically until 1916. No mining occurred at the Gilt Edge Mine between 1916 and 1935.

The Gilt Edge Mining Company was incorporated in South Dakota in 1935; the mine reopened in 1937 and operated until 1941 (EPA 2000). In 1938, the Gilt Edge Mine milling operation used a cyanidization gold extraction process that was capable of processing 125 tons of ore per day. Mercury amalgamation was used on the jig concentrate, while zinc was added to precipitate the gold (URS Operating Systems [UOS] 1999).

Production of gold and silver, along with small amounts of copper, lead, and zinc were reported from the properties at Gilt Edge. Copper caused losses in the cyanide circuit in 1940 which prompted management to install flotation cells; the copper concentrates were sold to Montana smelters. The mines also produced a small amount of tungsten in 1941. Underground mines include the Gilt Edge, Pyrite, Rattlesnake Jack, Hoodoo, Union Hill, and Anchor. The underground mining operations broke through to the surface leaving gloryhole openings and some limited surface mining at the site (UOS 1999).

Mill tailings were deposited in Strawberry Creek and Bear Butte Creek by Gilt Edge Mines, Inc. at the request of the residents of Galena and Sturgis in an effort to have the tailings plug up sink holes in Bear Butte Creek to preserve stream flow through the towns (EPA 2000). Mill tailings were discharged to Strawberry Creek until the mine closed in 1941. Piles of acidic tailings were left along Strawberry Creek. These tailings continually discharged acid and metals into Strawberry Creek, and contributed to sediment loads as the piles eroded. During the early 1980s, the SDDENR observed several tens of thousands of tons of acid-generating tailings in upper Strawberry Creek (UOS 1999). A spring at the base of these tailings was discharging water with a pH of 1.9. Underground mine entrances and shafts were also discharging acidic water and metals (EPA 2000). No aquatic life was observed in Strawberry Creek at that time.

In 1984, Gilt Edge, Inc. applied for a permit to begin a heap leach operation. By that time, Gilt Edge, Inc. had acquired the claims of the Hoodoo-Union Hill and Anchor Hill Mining companies. Gilt Edge, Inc. was acquired by Brohm Mining Corporation (BMC) before a permit was issued (UOS 1999).

In 1986, the SD Board of Minerals and Environment issued South Dakota Mining Permit No. 439 to BMC for the open pit/heap leach operations (UOS 1999). The permit contained several conditions that addressed the tailings and the potential for ARD. Over 150,000 tons of relic tailings were removed from the upper Strawberry Creek drainage by BMC beginning in 1993. The permit contained a condition that did allow the use of some of the tailings for the construction of the heap leach pad liner. Other tailings were mixed with fly ash from a local coal-fired power plant; these amended tailings were placed on upper portions of the pit benches and were topsoiled in 1994 (UOS 1999). Another condition of the permit required BMC to install a pumpback system designed to prevent acid discharges from the mine

workings from entering Strawberry and Bear Butte Creeks. Construction of the open-pit mine and cyanide heap leaching facilities was initiated in August 1987. Mining of the Dakota Maid and Sunday open pits was completed in 1992, which resulted in the removal of old glory hole openings.

In 1991, cyanide leaked from the cyanide heap leach pad into Strawberry Creek and Bear Butte Creek. Unpermitted discharges of acid water, aluminum, cadmium, copper, lead, and zinc from two areas were identified by EPA during an inspection in 1992 under the National Pollutant Discharge Elimination System (NPDES). In 1993, EPA issued an NPDES surface water discharge permit to BMC to address metals and cyanide discharges. Three NPDES compliance points were designated including one in Strawberry Creek, and two in Ruby Gulch, an intermittent tributary to Bear Butte Creek. NPDES permit violations based on low pH and levels in excess of permitted concentrations of cadmium, copper, and zinc have occurred on several occasions since the permit was issued.

Previous work done by BMC's consultant, OEA Research, Inc., documents the impact to benthic macro invertebrate communities along Strawberry Creek as well as downstream of the confluence of Strawberry Creek with Bear Butte Creek (UOS 1999). ARD from the Ruby Waste Dump was first detected in 1993.

Subsequent operations by BMC developed the North and Southeast Langley Pits and the Anchor Hill pit areas. A large-scale mining permit for the Anchor Hill deposit was issued by the State of South Dakota on January 19, 1996. The Anchor Hill project was split into Phase I located on private land and Phase II on USDA Forest Service land. Mining of the Phase I deposit was initiated in May of 1996 and completed by August of 1997. The Langley Pit area was mined at the same time (1996-1997) as Anchor Hill Phase I.

Phase II of the Anchor Hill project was delayed because of the need for completion of an Environmental Impact Statement by the USDA Forest Service. A favorable Forest Service decision was issued for Phase II of Anchor Hill in November 1997. However, in response to appeals, the USDA Forest Service withdrew its approval on February 18, 1998. On May 21, 1998, BMC reported that it would abandon the site by May 29, 1998. The state filed for a temporary restraining order to prevent BMC's abandonment of the Gilt Edge Mine site. The temporary restraining order was granted on May 29, 1998 in Circuit Court in Sturgis, SD. The temporary restraining order was followed by a preliminary injunction granted on June 5, 1998 in Circuit Court in Deadwood, SD. BMC's parent company, Dakota Mining Corporation, filed for bankruptcy in Canada in July 1999. SDDENR assumed water treatment operations using the South Dakota Regulated Substance Response Fund in 1999 and sought NPL listing from EPA in February 2000. The Site was placed on the National Priorities List in December 2000.

The EPA Region VIII Emergency Response Program assumed site-wide interim water-treatment operations and also began cleanup activities at the Ruby Gulch Waste Rock Dump (Ruby Dump) in August 2000. Site management and water treatment requirements, and also the Ruby dump construction costs, are severely straining the Region 8 emergency response budget and the ability for EPA to respond to additional emergency response needs elsewhere.

This ROD will transfer to the Remedial Program the response action and funding responsibility for the long-term cleanup of the Ruby Gulch Waste Rock Dump.

2.2.2 Enforcement-Related Activities

The following summarizes the history of documented releases of hazardous substances into surface water and related enforcement actions at the site.

December 1939 through September 1941 - Mine tailings were discharged down Strawberry Creek and into Bear Butte Creek. When the mine closed in 1941, piles of acidic tailings were left along Strawberry Creek. These tailings continually discharged acid and metal-laden water into the creek, until the bulk of the tailings were removed by BMC (BOR 2000).

June 20-21, 1991 - Cyanide leaked from the cyanide heap leach pad and was released into Strawberry Creek and Bear Butte Creek. Sodium cyanide was used in the heap leach process to extract gold from crushed ore (EPA 2000). The SDDENR issued BMC a Notice of Violation (NOV) and Order and received a penalty of \$99,800.

1991 - A Preliminary Assessment (PA) of the Gilt Edge Mine site was prepared in 1991 by the SDDENR.

May 19, 1992 - EPA conducted an NPDES inspection and found that two areas were discharging without a permit: (1) water seeping from the toe of Ruby Dump, and (2) pollutants from several point sources entering the Strawberry Creek diversion culvert through sedimentation ponds. The pH of the water from the toe of Ruby Dump was low and contained the following pollutants: ARD, aluminum, cadmium, copper, lead, and zinc. The pH of water discharged to Strawberry Creek was also low and contained the following pollutants: ARD, aluminum, cadmium, copper, iron, lead, and zinc (EPA 2000).

August 10, 1992 - EPA transmitted an inspection report to BMC requiring application for a NPDES permit (EPA 2000).

November 24, 1992 - EPA issued Findings of Violation and Order for Compliance setting forth monitoring requirements and interim performance standards for Strawberry Creek and Ruby Gulch (EPA 2000).

April 19, 1993 - SDDENR issued a Notice of Violation based on low pH and concentrations of sulfate, aluminum, copper, iron, manganese, and zinc in the Ruby Gulch discharge (EPA 2000).

September 14, 1993 - EPA executed an Order for Compliance on Consent, which superseded the November 24, 1992 order (EPA 2000).

September 15, 1993 - EPA issued NPDES permit Number SD-0026891 to BMC (EPA 2000).

February 15, 1994 - SDDENR issued a letter regarding NPDES permit violations at Compliance Point 002 in Ruby Gulch (for pH, cadmium, copper, and zinc) in February 1994 (EPA 2000).

March 31, 1994 - EPA issued a Notice of Proposed Assessment of Class II Civil Penalty on NPDES permit Number SD-0026891 (EPA 2000).

August 25, 1994 - EPA issued a Consent Order based on permit violations including February 1994 violations in Ruby Gulch (EPA 2000).

February 20, 1997 - The SDDENR issued a NOV for the discharge of acid mine discharges into Strawberry Creek. Brohm paid a \$5,400 penalty.

September 15, 1997 - The SDDENR issued a NOV for two discharges of acid mine discharges into Strawberry Creek. Brohm paid an \$18,000 penalty.

March 31, 1994 through January 31, 2000 - Numerical violations of NPDES permit limits at Compliance Points 001 and 002 (EPA 2000).

September 5, 1998 - SDDENR issued a Notice of Violation and Order for Compliance for NPDES permit violations (including cadmium, copper, zinc) at Strawberry Creek Compliance Point 001 in 1996, 1997, and 1998 (EPA 2000).

July 1999 - The SDDENR averted an acid water discharge by taking over necessary water treatment operations at the site using the State's Regulated Substance Response Fund. SDDENR maintained the water treatment plant to remove metals using standard pH adjustment methods with sludges discharged back into an open pit.

1999 - UOS prepared the Site Investigation (SI) for the site in 1999. Soil, sediment, and surface water samples were collected and analyzed for heavy metals and cyanide during the SI (UOS 1999).

2000 - In February 2000 the Governor of South Dakota requested that EPA propose the site for the Superfund National Priorities List (NPL) and provide emergency response, as well as long term remedial cleanup. The Site was proposed for NPL listing on May 11, 2000. The final listing of the site was on December 1, 2000.

Present - Superfund removal and remedial programs have begun cleanup remedial investigations and feasibility studies.

2.3 Community Participation

On May 2, 2001 a public information meeting was held in Deadwood by EPA Region VIII's Office of Community and Public Involvement and the Superfund Remedial Program.

The Proposed Plan for OU3 at the Gilt Edge Mine site was made available to the public in April 2001. It can be found in the Administrative Record file and the information repository maintained at the EPA Docket Book in Region VIII and at the Lead Community Library. The notice of the availability of the Proposed Plan was published in the Lawrence County Centennial Newspaper on April 27, 2001. A public comment period was held from April 27,

2001 to May 28, 2001. Three written comments pertaining to this Proposed Plan were received. In addition, a public meeting was held on May 2, 2001 to present the Proposed Plan to a broader community audience than those that had already been involved at the site. At this meeting, representatives from EPA, SDENR, and South Dakota Department of Transportation (SDDOT) answered questions about the site and the remedial alternatives. Part 3, the Responsiveness Summary addresses questions and comments taken at the May 2 public meeting.

2.4 Scope and Role of Operable Unit

As with many Superfund sites, the problems at the Gilt Edge Mine Site are complex. As a result EPA has organized the site management and remedial response activities into three operable units:

- Operable Unit 1: Site-Wide Gilt Edge Mine
- Operable Unit 2: Interim Water Treatment (Early-Action and Interim ROD's)
- Operable Unit 3: Ruby Gulch Waste Rock Dump

Operable Unit 3, the subject of this Interim ROD, addresses contamination associated with the largest ARD source on the site, the Ruby Gulch Waste Rock Dump (Ruby Dump). ARD generating from the sulfide materials of the Ruby Dump, if not reduced and contained, poses a major threat of erosion, contamination, and flows into the Ruby Gulch drainage and Bear Butte Creek. This ROD addresses this threat by reducing the volume of contaminated materials exposed at OU3, reducing infiltration that produces large quantities of ARD, and containing the materials of the Ruby Dump. EPA completed a Focused Feasibility Study for the dump cap in March 2001. This Interim ROD will be consistent with and will not preclude implementation of the final remedy(ies) at the Site.

Operable Unit 1 - the Site-Wide Gilt Edge Mine, will address contamination of the overall sources. OU1 will address all remedy components for the site including final water treatment plans and any residual risks associated with the Ruby Dump. EPA is currently implementing a remedial investigation and feasibility study and a site-wide risk assessment for this operable unit.

Operable Unit 2 - Interim Water Treatment, will address the continuing need to treat residual waters from the Ruby Dump along with the ARD of the remainder the site. Discharge of this water without treatment poses a current and potential risk to the environment because contaminant concentrations are greater than the Surface Water Quality Criteria for Strawberry Creek and Bear Butte Creek.

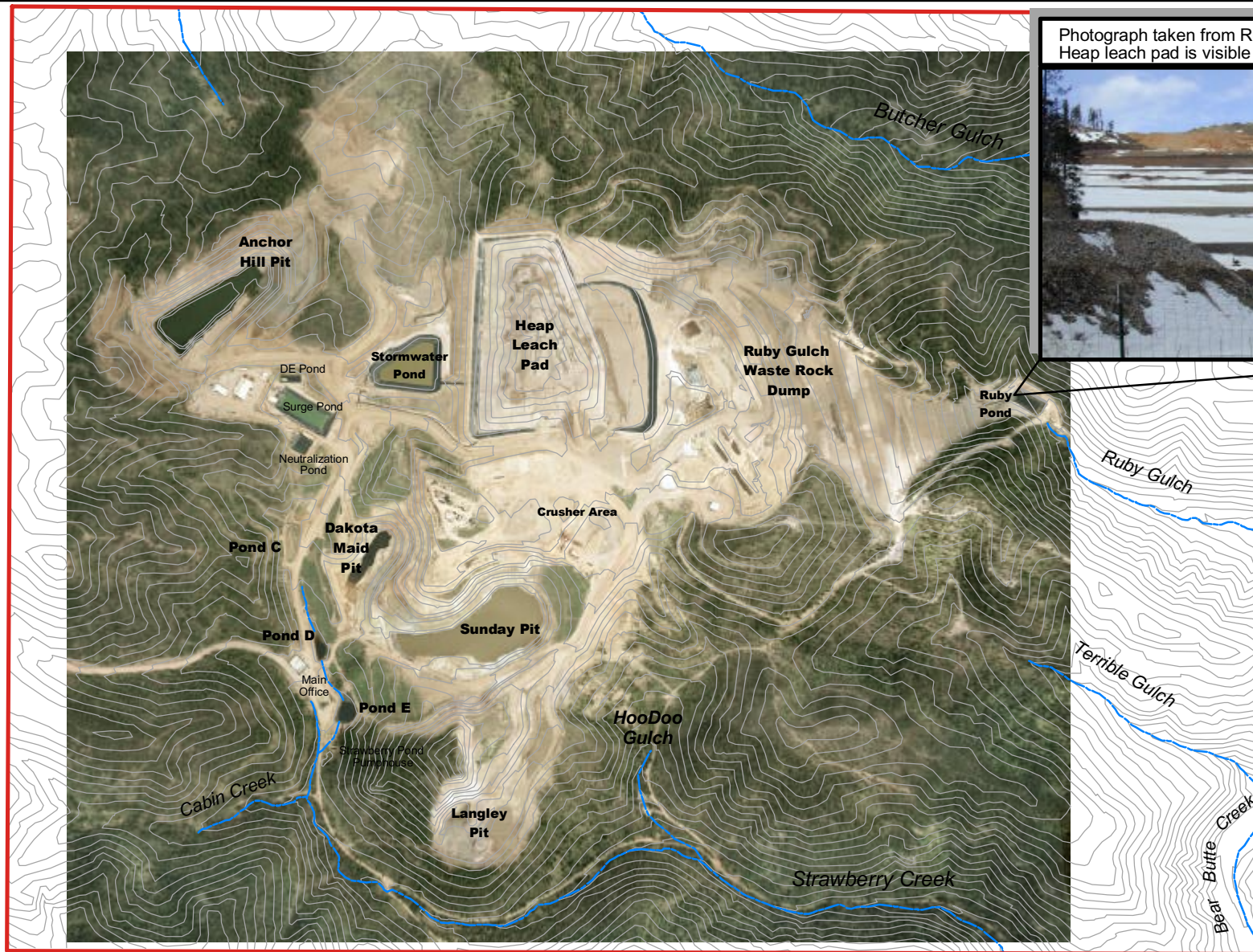
2.5 Site Characteristics

2.5.1 Surface Features

The Gilt Edge Mine NPL Site is located in the Black Hills of South Dakota, immediately adjacent to the upper reaches of Strawberry Creek and Ruby Gulch. The area has mountainous topography with elevations from approximately 5,100 to 5,680 feet above mean sea level (UOS 1999). The Site (see Figure 1) consists of a variety of features listed below.

This ROD specifically focuses on the Ruby Gulch Waste Rock Dump.

- Ruby Gulch Waste Rock Dump (59.1 acres) was constructed as a tiered valley fill in the Ruby Gulch drainage, for disposal of waste rock from the mining activities as well as spent ores from the leach pads. The Ruby Waste Rock Dump (Ruby Dump) is recognized as a significant source of ARD from the Gilt Edge mining operations (UOS 1999).
- Ruby Pond is a containment pond located in the Ruby Gulch drainage at the toe of the Ruby Dump to capture the ARD emanating from the waste rock. This lined pond has a reported capacity of 1,200,000 gallons. The ARD that drains from the Ruby Dump is collected in the containment pond and then pumped to the Sunday pit for storage prior to treatment. The ARD is treated at an onsite water treatment plant and released into the Strawberry Creek drainage. ARD from other site sources, including the Anchor Hill Pit and Dakota Maid Pit, is also pumped to the Sunday Pit for holding and treatment.
- Heap Leach Pad covers 37 acres with approximately 3.2 million tons of spent ore. Two eastward expansions to this pad were built, however, no ore was processed on the last expansion pad. The heap leach pad and its expansion areas consist variously of an asphalt and several types of polyethylene and soil composite liner materials.
- Sunday Pit is a 29.5-acre pit that is partially backfilled. In October 2000, the pit contained approximately 65 million gallons of acid water.
- Dakota Maid Pit is a 17.1-acre pit that is partially backfilled. In October 2000, the pit contained no standing water.
- Langley Pit is an 8.1-acre pit mined by BMC in early 1997. The northern portion of the pit is partially backfilled.
- Anchor Hill Pit is a 23.6-acre pit mined as recently as 1997. In October 2000 the pit contained 56 million gallons of acid water.
- Process Plant and Ponds occupy 14.5 acres and include the plant buildings, Surge Pond, Neutralization Pond, and Diatomaceous Earth Pond, all constructed with HDPE primary liners and HDPE/soil composite secondary liners (EPA 2000).
- Ponds C, D, E, and the Stormwater Pond occupy approximately 15 acres.



Photograph taken from Ruby Pond looking west. Heap leach pad is visible in the background.



LEGEND

- Creek or Stream
- Topographic Contour - 25-foot interval
- Mine Site Extent

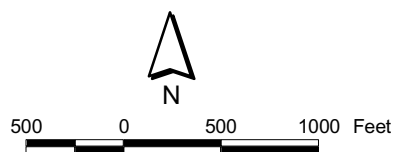


FIGURE 1

RUBY WASTE ROCK DUMP AND VICINITY

GILT EDGE MINE SITE
LAWRENCE COUNTY, SOUTH DAKOTA

- Crusher Area and Ore Storage covers 10.3 acres (EPA 2000).
- Various fill materials used for constructing haul and access roads are reportedly a source for AMD; unknown quantity (EPA 2000).
- Relic tailings in Hoodoo Gulch; unknown quantity (EPA 2000).

2.5.2 Geology

2.5.2.1 Regional Setting

The Gilt Edge Mine NPL Site is located in the North-Central Black Hills of South Dakota in an area intruded by Tertiary age igneous rocks. The site hosts many rock types and has a complicated geologic structure (BOR 2000).

The porphyry ores historically mined at the site occur in thin sheets of auriferous limonite in small fractures or impregnations of decomposed parts of the porphyry. The limonite merges downward into pyrite and other sulfides, particularly copper sulfide. The main ore shoots occur where parallel and cross fracturing have formed brecciated zones that have become partly or wholly mineralized. The shoots are irregular in shape; some have been stoped as much as 100 feet in length and 50 feet in width (UOS 1999). Recent open pit mining has exposed large areas of sulfide bearing high walls and acid-generating fills to precipitation and groundwater.

2.5.2.2 Soils

There are three different soil associations encountered at the Gilt Edge Mine site. These are the Mine Dumps (Cc), the Grizzly-Virkula association, steep (GBE), and the Virkula association, hilly (VCE).

Grizzly soils are: low in fertility and organic matter content; available water capacity is high; permeability is moderately slow; runoff is rapid; the soils have high shrink-swell potential.

Virkula soils are: low in fertility and organic matter content; available water capacity is moderate to high ; permeability is moderately slow; runoff is medium to rapid; the soils have high shrink-swell potential.

2.5.3 Climate

According to the Great Plains International Data Network, mean, minimum, and maximum temperatures in January and July are 5 and 33 degrees Fahrenheit (F), and 55 F and 80 F, respectively near the mine site. Mean number of freeze-free days is 150 near the site with prevailing winds out of the northwest at approximately 10 to 13 miles per hour (UOS 1999).

Mean annual precipitation in the Black Hills area ranges from 19 to 24 inches. Mean annual snowfall is approximately 60 to 100 inches per year (UOS 1999). Precipitation is higher at the Site, ranging from 25 to 30 inches per year. For the purposes of stormwater modeling, the 10-year, 24-hour storm event was rated at 3.1 inches of precipitation and the 100-year, 24-hour storm event was rated at 6.0 inches of precipitation. In response to measurements of intense storms at the mine in the 1990s, mine consultants Steffen, Robertson, and Kirsten revised upwards the design storm events for the site to 9.47 inches for the 100-year, 24-hour event, 5.87 inches for the 25-year, 24-hour event, and 4.28 inches for the 10-year, 24-hour event. The Probable Maximum Precipitation (PMP) event has been estimated to be a 6-hour storm event of 19.6 inches (BOR 2000). These precipitation events and rates drive the water accumulations, resulting in continued ARD generation and the need (1) for water treatment at the site and (2) actions to reduce infiltration and ARD generation– the objective of this Interim Record of Decision.

2.5.4 Site Groundwater

Detailed site investigations regarding groundwater aspects are ongoing as part of the site-wide studies. Groundwater is known to be a contributor to water inflows into the western portion (OU1) of the site. In addition, investigations in the Dakota Maid and Sunday Pit areas of OU1 indicate that fault and fracture zones are flow paths that can convey waters from the pit zones into the Strawberry Creek drainage alluvial and bedrock aquifers.

Groundwater monitoring wells GW-8 and GW-9, are respectively alluvial and bedrock wells at the top of the Ruby Waste Dump. Well GW-9 was abandoned in 1996.

Well GW-9, a bedrock well near the toe of the Ruby Waste Rock Dump, does not show significant changes over time and the chemistry does not suggest major impact from ARD. Well GW-8, which is a shallow alluvial well, has shown significant degradation in water quality over time as the dump has changed to strongly acid-generating conditions. The pH has declined significantly, while total dissolved solids (TDS) have increased. Trace elements have also typically increased in concentration over time, with the exception of iron (Fe), which has decreased.

Groundwater monitoring wells GW-8A and GW-9A are, respectively, alluvial and bedrock wells located approximately 600 feet downgradient from the Ruby Waste Rock Dump cutoff trench. Concentrations of pH, TDS, arsenic (As), cadmium (Cd), copper (Cu), iron (Fe), and zinc (Zn) present in wells GW-8A and GW-9A indicate ARD water produced from the Ruby Waste Rock Dump is being captured by the Ruby Dump cutoff trench and pond. There was no corresponding increase in trace elements at either the alluvial well (GW-8A) or the bedrock well (GW-9A) when the increase occurred at well GW-8.

2.5.5 Site Surface Water

The site is located at the headwaters of Strawberry Creek (a perennial stream) and Ruby Gulch (which is ephemeral in the upper reaches and intermittent in the lower reaches of the drainage). Strawberry Creek and the Ruby Gulch drainage are tributaries to Bear Butte Creek, a

northeastward-flowing perennial stream. Hoodoo Gulch, a relatively small tributary to Strawberry Creek, joins Strawberry Creek below the mining operation. Nearby Boomer Gulch is a tributary that joins Strawberry Creek from the south approximately 1,500 feet above the confluence of Strawberry Creek and Bear Butte Creek (EPA 2000).

The surface water at the Gilt Edge site drains through three sub-basins into Bear Butte Creek. The sub-basins are Strawberry Creek drainage, Hoodoo Gulch, and Ruby Gulch, are 0.39, 0.05, and 0.07 square miles in area, respectively. The topography is characterized by mountainous terrain with narrow valleys. Anchor Hill forms the highest point on the north side of the site at an elevation of 5,680 feet. An unnamed peak on the east side of the site is at elevation 5,650 feet. The lowest point is at approximately 4,880 feet at the confluence of Bear Butte and Ruby Gulch. The mountain slopes range from 6 to 60 percent and the soil permeability is classified as moderate, averaging about 4 inches per hour (BOR 2000).

The largest source and volume of ARD generating material at the site is the Ruby Waste Rock Dump (Ruby Dump) in the headwaters of Ruby Gulch.

Precipitation at the Gilt Edge mine site averages 29 inches per year. Sources of sulfide and metal contamination have been documented in the Ruby Dump, resulting in substantial ARD. ARD-generating waste rock from Ruby Dump, if not capped and contained to reduce infiltration, will continue to be a major threat of erosion, contamination, and potential releases of contaminated flows into the Ruby Gulch drainage and Bear Butte Creek.

At the toe of the waste rock dump (where runoff and leachates from the dump report again to the surface) a containment pond (Ruby Pond) was built to intercept and prevent ARD contaminated waters from flowing into the Ruby Gulch drainage. This lined pond has a capacity of approximately 1.2 million gallons and the ARD from the Ruby Dump is then pumped to the Sunday Pit for storage prior to treatment. The handling and treatment of this ARD at the onsite water treatment plant is being evaluated and managed as part of Operable Unit 2 - Interim Water Treatment Operations.

2.5.6 Ruby Waste Rock Dump Contaminant Characterization

Waste rock from the mining activities and spent ores from the leach pads were transported to the Ruby Dump, a tiered storage area for waste rock in the Ruby Gulch drainage. The Ruby Dump Waste Rock Dump (Ruby Dump) was part of the Gilt Edge mining process and is currently recognized as a significant source of ARD at the site.

The Ruby Dump was constructed by end-dumping rock in layers up to 50 feet thick. Rock materials ranging from sand size to boulders are present in the dump. Compaction was achieved by routing haul equipment over the dump. By using the end-dumping method to place these materials, large boulders accumulated at the base of the lifts, and a French drain effect was created in the lower portions of the dump. The dump is very porous and permeable. The dump contains an estimated 15.8 million tons of waste rock and 4.2 million tons of spent ore occupying a volume of approximately 12 million cubic yards. The uppermost ungraded portion of the dump contains slopes at various angles of repose. Robertson GeoConsultants

Inc. evaluated the rock materials of the Ruby Dump and documented widespread occurrence of ARD-generating materials (Robertson 2000).

Drainage ditches had been placed on the sides of the dump, and the main dump slope was placed and partially graded at a 3 to 1 slope with several benches that stair-step down the gulch. The drainage ditches are in poor condition. Current dump slopes range from angle of repose to 3 :1 slope and need to be reduced to 3.5:1 for long-term stability.

Precipitation that infiltrates into the Ruby Dump results in the generation of approximately 30 million gallons of ARD per year that must undergo metals-removal treatment. Monthly average ARD flows from Ruby Dump for September, 1999 through August, 2000 ranged from 15 to 172 gallon per minute (gpm) averaging 58 gpm. This represents a significant source of ARD generation and high levels of contaminants have been documented. Water quality data from September 2000 are shown in the table below, indicating the extreme toxicity of ARD waters emanating from the Ruby Dump.

Table 1. Ruby Pond Sample Results Fall 2000

Analyte	Results in parts per billion (ppb)	Surface Water Quality Standard (ppb)
pH	2.54 standard units (S.U.)	6.5-8.8 S.U.
Arsenic	3,045	190
Cadmium*	783	2.9
Copper*	61,500	37.1
Selenium	48	5
Zinc*	22,550	338.3

* hardness dependent, based on a CaCO₃ hardness of 400 mg/l.

2.6 Current and Potential Future Site and Resource Uses

The site is currently an abandoned hard rock mine. The Site and the surrounding area is zoned as a PF - Park Forest District by Lawrence County. The usages permitted in the PF - Park Forest District include:

- Detached single-family dwellings, cabins, and summer homes;
- Transportation and utility easements, alleys, and right-of-way;
- Public parks and/or playgrounds;
- Historical monuments or structures;
- Utilities substations;
- Plant nursery;

Tree or crop growing areas and grazing lands;

For lots adjacent to a stream, drain field setbacks shall be at least one hundred (100) feet from the stream's high water mark.

Residential usage may include normal home occupations and offices of recognized profession provided:

1. They are conducted by the occupant;
2. Advertising shall conform to sign regulations;

Other uses approved under County and State Conditional Use Permits

Special use permits issued by the County and mining permits issued by the State contain land-use restrictions that remain in effect for the Site.

2.7 Site Risks

Site-wide risk assessments that closely evaluate human health and ecological risk are in the early stages of evaluation. Remedial investigations and risk assessments identify sources of contamination (volume and toxicity), the pathways for contaminant releases, and the effects of potential exposure and contaminant concentrations. While the risk assessments focus on toxicological risk effects of exposure and dose, this Interim Remedial Action aims to reduce a major source of contamination and the threat of releases from the site that could adversely affect downstream water supplies.

The most significant threat to human health and the environment at this Site stems from the potential for releases of metal-contaminated ARD to offsite receptors (downstream fisheries and residential and municipal water users). Even though ARD waters within the Site are being controlled and treated to prevent off-site releases, there is always the potential for large precipitation events to overwhelm the water control systems (Operable Unit 2).

Because the Ruby Gulch Waste Rock Dump (Operable Unit 3) is the largest volume contaminant source at the Site, this Interim Record of Decision implements remedial action at the Ruby Dump source to significantly reduce (by an estimated 30 million gallons) the quantity of ARD emanating from this source, and add significantly to the operational integrity and protectiveness of Interim Water Treatment (Operable Unit 2).

EPA has completed a Screening Ecological Risk Assessment for the Gilt Edge Mine study area. Preliminary results from this screening identify contaminants of potential concern (COPC) for aquatic and wildlife receptors exposed to surface water as aluminum, arsenic, cadmium, chromium, copper, nitrate, lead, nickel, selenium, silver, and zinc. COPCs for aquatic and wildlife receptors exposed to sediment are aluminum, arsenic, cadmium, copper, lead, mercury, manganese, nickel, silver, and zinc. Measured concentrations of arsenic, cadmium, copper, selenium, and zinc are above toxicity levels for aquatic receptors.

2.8 Remedial Action Objectives

Remedial Action Objectives (RAOs)

RAOs are media-specific (e.g., mine waste, ARD, etc.) and meet the goal of protecting the environment.

The RAOs for OU3 are to:

Control erosion of mine waste contaminants into Ruby Gulch and Bear Butte Creek
Reduce formation and volume of ARD
Reduce leaching and migration of contaminants from mine waste into surface water
Reduce leaching and migration of contaminants from mine waste that may enter groundwater

Construction of the proposed cap and drainage system will intercept and divert precipitation inflows, reducing water treatment volumes by approximately 30 million gallons per year. Containment and capping of the waste rock will also isolate contaminants, thereby preventing erosional release of metal-laden sediment into downstream drainages. This response action is also intended to reduce the risk of release of untreated ARD flows to Bear Butte Creek.

2.9 Description of Alternatives

Thirteen alternatives were evaluated for this ROD. These alternatives are based on various combinations of liner materials, repository locations, and cap cover materials, as follows:

Cap impermeable layer:	Geomembrane liner	Clay composite liner
Waste placement in:	Upper Ruby Gulch drainage	Existing mine pits
Protective cover and surface controls material:	Onsite spent ore	
	Offsite highway project rock	
	Offsite commercial materials	

- Alternative 1 – No Action

Geomembrane Cap Options

Placing Excess Waste Rock Into the Upper Ruby Gulch Drainage:

- Alternative 2a – Excavation and Disposal of Waste Rock Into the Upper Ruby Gulch Drainage, Grading, Composite Geomembrane Cap Using Onsite Materials, and Surface Water Controls

- Alternative 2b – Excavation and Disposal of Waste Rock Into the Upper Ruby Gulch Drainage, Grading, Composite Geomembrane Cap Using Offsite Highway Project Materials, and Surface Water Controls
- Alternative 2c – Excavation and Disposal of Waste Rock Into the Upper Ruby Gulch Drainage, Grading, Composite Geomembrane Cap Using Offsite Commercial Materials, and Surface Water Controls

Placing Excess Waste Rock Into Existing Mine Pits in the Strawberry Creek Watershed:

- Alternative 3a – Excavation and Disposal of Waste Rock Into the Existing Mine Pits, Grading, Composite Geomembrane Cap Using Onsite Materials, and Surface Water Controls
- Alternative 3b – Excavation and Disposal of Waste Rock Into Existing Mine Pits, Grading, Composite Geomembrane Cap Using Offsite Highway Project Materials, and Surface Water Controls
- Alternative 3c – Excavation and Disposal of Waste Rock Into Existing Mine Pits, Grading, Composite Geomembrane Cap Using Offsite Commercial Materials, and Surface Water Controls

Composite Soil Cap Options

Placing Excess Waste Rock Into the Upper Ruby Gulch Drainage:

- Alternative 4a – Excavation and Disposal of Waste Rock Into the Upper Ruby Gulch Drainage, Grading, Composite Soil Cap Using Onsite Materials, and Surface Water Controls
- Alternative 4b – Excavation and Disposal of Waste Rock Into the Upper Ruby Gulch Drainage, Grading, Composite Soil Cap Using Offsite Highway Project and Commercial Materials, and Surface Water Controls
- Alternative 4c – Excavation and Disposal of Waste Rock Into the Upper Ruby Gulch Drainage, Grading, Composite Soil Cap Using Offsite Commercial Materials, and Surface Water Controls

Placing Excess Waste Rock Into Existing Mine Pits in the Strawberry Creek Watershed:

- Alternative 5a – Excavation and Disposal of Waste Rock Into Existing Mine Pits, Grading, Composite Soil Cap Using Onsite Materials, and Surface Water Controls
- Alternative 5b – Excavation and Disposal of Waste Rock Into Existing Mine Pits, Grading, Composite Soil Cap Using Offsite Highway Project and Commercial Materials, and Surface Water Controls
- Alternative 5c – Excavation and Disposal of Waste Rock Into Existing Mine Pits, Grading, Composite Soil Cap Using Offsite Commercial Materials, and Surface Water Controls

It should be noted that at the time the Focused Feasibility Study for the Ruby Gulch Waste Rock Dump was being prepared, a portion of the Upper Ruby Gulch Drainage being evaluated

for repository placement was Black Hills National Forest property administered by the USDA Forest Service. Under the Small Tracts Act, the State of South Dakota purchased from the Forest Service several parcels that could be used for repository and diversion construction.

2.9.1 Description of Remedy Components

Alternative 1 - No Action

The No Action alternative would discontinue all remedial activities at the Ruby Dump. There would be no change in the solids contaminant concentrations and generation of ARD because no treatment, containment, or removal of mine waste is included in this alternative. Alternative 1 includes annual surface and ground water monitoring and 5-year site reviews since waste remains onsite above preliminary remedial action goals.

Alternative 2a - Excavation and Disposal of Waste Rock Into the Upper Ruby Gulch Drainage, Grading, Composite Geomembrane Cap Using Onsite Materials, and Surface Water Controls

Cap impermeable layer:	Geomembrane liner	Clay / spent ore composite
Waste placement in:	Upper Ruby Gulch drainage	Existing mine pits
Protective cover and surface controls material:	Onsite spent ore	
	Offsite highway project rock	
	Offsite commercial materials	

Steep slopes at the Ruby Dump would be graded to a 3.5 horizontal to 1 vertical (3.5H:1V) slope. Waste rock needing to be excavated and moved to achieve required grade on the Ruby Dump would be placed as fill in depressions along the drainage north of Ruby Dump to reestablish and control surface water flow. Spent oxide ore from the heap leach pad would be placed over the Ruby Dump as a bedding layer. A multilayer cap would be constructed on the finished grade of the Ruby Dump. The cap would consist of an 80 mil low density polyethylene (LDPE) geomembrane liner, drainage net layer, geotextile filter fabric, protective layer of spent oxide ore amended with limestone, and growth media layer amended with organic material and limestone to promote vegetative cover. This alternative assumes that onsite materials (spent oxide ore and growth media) used for cap construction above the geomembrane liner and for surface water controls are not ARD-generating after amendment and would be suitable for the intended purposes.

Surface water controls would consist of a benched drainage system and diversion ditches built using spent oxide ore amended with limestone. The benched drainage system would be constructed on the cap surface for erosion control and to channel runoff to diversion ditches.

Diversion ditches would be constructed on the edges of the cap to channel runoff from the benched drainage system around the existing Ruby Pond. Surface water and source controls would be realized through the construction of the composite geomembrane cap and surface water controls.

Alternative 2a would also include annual inspections, maintenance of the cap and surface water controls, surface and groundwater water monitoring, and 5-year site reviews.

Alternative 2b - Excavation and Disposal of Waste Rock Into the Upper Ruby Gulch Drainage, Grading, Composite Geomembrane Cap Using Offsite Highway Project Materials, and Surface Water Controls

Cap impermeable layer:	Geomembrane liner	Clay / spent ore composite
Waste placement in:	Upper Ruby Gulch drainage	Existing mine pits
Protective cover and surface controls material:	Onsite spent ore	
	Offsite highway project rock	
	Offsite commercial materials	

Alternative 2b is similar to Alternative 2a except offsite materials for construction of the protective layer and surface water controls would be obtained from a highway construction project in the immediate vicinity of the Gilt Edge Mine site. The rock at the highway project has been tested and is not ARD-generating, but would require crushing and screening to obtain suitable construction materials. Growth media would be obtained from onsite sources as described in Alternative 2a. This alternative assumes that offsite highway project materials would meet specifications after crushing and screening and would not require amendments.

Alternative 2b would also include annual inspections, maintenance of the cap and surface water controls, surface and ground water monitoring, and 5-year site reviews.

Alternative 2c – Excavation and Disposal of Waste Rock Into the Upper Ruby Gulch Drainage, Grading, Composite Geomembrane Cap Using Offsite Commercial Materials, and Surface Water Controls

Cap impermeable layer:	Geomembrane liner	Clay / spent ore composite
Waste placement In:	Upper Ruby Gulch drainage	Existing mine pits
Protective cover and surface controls material:	Onsite spent ore	
	Offsite highway project rock	
	Offsite commercial materials	

Alternative 2c is similar to Alternative 2a except offsite materials from commercial sources (e.g., quarry operations) would be used for construction of the cap and the surface water controls. Materials for the protective layer and the surface water controls would be hauled from preselected offsite commercial borrow pits. Growth media would be obtained from onsite sources as described in Alternative 2a. This alternative assumes that offsite commercial materials would meet specifications and not require amendments.

Alternative 2c would also include annual inspections, maintenance of the cap and surface water controls, surface and ground water monitoring, and 5-year site reviews.

Alternative 3a – Excavation and Disposal of Waste Rock Into Existing Mine Pits, Grading, Composite Geomembrane Cap Using Onsite Materials, and Surface Water Controls

Cap impermeable layer:	Geomembrane liner	Clay / spent ore composite
Waste placement In:	Upper Ruby Gulch drainage	Existing mine pits
Protective cover and surface controls material:	Onsite spent ore	
	Offsite highway project rock	
	Offsite commercial materials	

The depressions north of Ruby Dump would not be used as part of the Ruby Dump cap under Alternative 3a. Waste rock that was to be used as fill for the depressions along the drainage north of Ruby Dump would instead be used as fill for onsite mine pits in the Strawberry Creek drainage. Note: final closure requirements for onsite mine pits in these areas would be addressed under the sitewide operable unit (OU1). Because this alternative would require re-opening the upper Ruby Gulch drainage presently blocked by waste rock, Alternative 3a involves a greater cut volume of

waste rock than Alternative 2a, thus increasing capital cost. The cap construction would be similar to Alternative 2a except that slope directions would vary slightly since the depressions are not used. The surface water diversion controls would also have to be constructed on a different alignment. This alternative assumes that onsite materials (spent oxide ore and growth media) used for cap construction above the geomembrane liner and for surface water controls are not ARD-generating after amendment and would be suitable for the intended purposes.

Alternative 3a would also include annual inspections, maintenance of the cap and surface water controls, surface and ground water monitoring, and 5-year site reviews.

Alternative 3b - Excavation and Disposal of Waste Rock Into Existing Mine Pits, Grading, Composite Geomembrane Cap Using Offsite Highway Project Materials, and Surface Water Controls

Cap impermeable layer:	Geomembrane liner	Clay / spent ore composite
Waste placement In:	Upper Ruby Gulch drainage	Existing mine pits
Protective cover and surface controls material:	Onsite spent ore	
	Offsite highway project rock	
	Offsite commercial materials	

Alternative 3b is similar to Alternative 3a except offsite materials for construction of the protective layer and surface water controls would be obtained from a highway construction project in the immediate vicinity of the Gilt Edge Mine site. The rock at the highway project has been tested and is not ARD-generating, but would require crushing and screening to obtain suitable construction materials. Growth media would be obtained from onsite sources as described in Alternative 3a. This alternative assumes that offsite highway project materials would meet specifications after crushing and screening and would not require amendments.

Alternative 3b would also include annual inspections, maintenance of the cap and surface water controls, surface and ground water monitoring, and 5-year site reviews.

Alternative 3c – Excavation and Disposal of Waste Rock Into Existing Mine Pits, Grading, Composite Geomembrane Cap Using Offsite Commercial Materials, and Surface Water Controls

Cap impermeable layer:	Geomembrane liner	Clay / spent ore composite
Waste placement In:	Upper Ruby Gulch drainage	Existing mine pits
Protective cover and surface controls material:	Onsite spent ore	
	Offsite highway project rock	
	Offsite commercial materials	

Alternative 3c is similar to Alternative 3a except offsite materials from commercial sources (e.g., quarry operations) would be used for construction of the cap and the surface water controls. Materials for the protective layer and the surface water controls would be hauled from preselected offsite commercial borrow pits. Growth media would be obtained from onsite sources as described in Alternative 3a. This alternative assumes that offsite materials would meet specifications and not require amendments.

Alternative 3c would also include annual inspections, maintenance of the cap and surface water controls, surface and ground water monitoring, and 5-year site reviews.

Alternative 4a – Excavation and Disposal of Waste Rock Into the Upper Ruby Gulch Drainage, Grading, Composite Soil Cap Using Onsite Materials, and Surface Water Controls

Cap impermeable layer:	Geomembrane liner	Clay / spent ore composite
Waste placement In:	Upper Ruby Gulch drainage	Existing mine pits
Protective cover and surface controls material:	Onsite spent ore	
	Offsite highway project rock	
	Offsite commercial materials	

Alternative 4a is similar to Alternative 2a except a 2-foot low permeability layer consisting of compacted spent oxide ore amended with 10 percent bentonite by weight would be used as the low permeability layer instead of an LDPE geomembrane. The protective layer consisting of limestone-amended spent oxide ore for this alternative would be 4 feet thick, 2 feet thicker than that used for Alternative 2a. This alternative assumes that onsite materials (spent oxide ore and growth media) used for cap construction and for surface water controls are not ARD-

generating after amendment and would be suitable for the intended purposes. The bentonite would be obtained from offsite commercial sources.

Alternative 4a would also include annual inspections, maintenance of the cap and surface water controls, surface and ground water monitoring, and 5-year site reviews.

Alternative 4b – Excavation and Disposal of Waste Rock Into the Upper Ruby Gulch Drainage, Grading, Composite Soil Cap Using Offsite Highway Project and Commercial Materials, and Surface Water Controls

Cap impermeable layer:	Geomembrane liner	385/clay-offsite materials composite
Waste placement In:	Upper Ruby Gulch drainage	Existing mine pits
Protective cover and surface controls material:	Onsite spent ore	
	Offsite highway project rock	
	Offsite commercial materials	

Alternative 4b is similar to Alternative 4a except offsite materials for construction of the low permeability layer, protective layer, and surface water controls would be obtained from a highway construction project in the immediate vicinity of the Gilt Edge Mine site. The rock at the highway project has been tested and is not ARD-generating, but would require crushing and screening to obtain suitable construction materials. Since there would not be enough offsite highway rock, additional cap construction materials would be required from commercial sources. Growth media would be obtained from onsite sources as described in Alternative 4a. This alternative assumes that offsite highway project and commercial materials would meet specifications after crushing and screening and would not require amendments.

Alternative 4b would also include annual inspections, maintenance of the cap and surface water controls, surface and ground water monitoring, and 5-year site reviews.

Alternative 4c – Excavation and Disposal of Waste Rock Into the Upper Ruby Gulch Drainage, Grading, Composite Soil Cap Using Offsite Commercial Materials, and Surface Water Controls

Cap impermeable layer:	Geomembrane liner	Clay-offsite materials composite
Waste placement In:	Upper Ruby Gulch drainage	Existing mine pits
Protective cover and surface controls material:	Onsite spent ore	
	Offsite highway project rock	
	Offsite commercial materials	

Alternative 4c is similar to Alternative 4a except offsite materials from commercial sources (e.g., quarry operations) would be used for construction of the cap and the surface water controls. Materials for the low-permeability layer, protective layer, and the surface water controls would be hauled from preselected offsite commercial borrow pits. Growth media would be obtained from onsite sources as described in Alternative 4a. This alternative assumes that offsite materials would meet specifications and not require amendments.

Alternative 4c would also include annual inspections, maintenance of the cap and surface water controls, surface and ground water monitoring, and 5-year site reviews.

Alternative 5a – Excavation and Disposal of Waste Rock Into Existing Mine Pits, Grading, Composite Soil Cap Using Onsite Materials, and Surface Water Controls

Cap impermeable layer:	Geomembrane liner	Clay / spent ore composite
Waste placement In:	Upper Ruby Gulch drainage	Existing mine pits
Protective cover and surface controls material:	Onsite spent ore	
	Offsite highway project rock	
	Offsite commercial materials	

Alternative 5a is similar to Alternative 3a except a 2-foot low permeability layer consisting of compacted spent oxide ore amended with 10 percent bentonite by weight would be used as the low permeability layer instead of an LDPE geomembrane. The protective layer consisting of limestone-amended spent oxide ore for this alternative would be 4 feet thick, 2 feet thicker than that used for Alternative 3a. This alternative assumes that onsite materials (spent oxide ore and growth media) used for cap construction and the surface water controls are not ARD-

generating after amendment and would be suitable for the intended purposes. The bentonite would be obtained from offsite commercial sources.

Alternative 5a would also include annual inspections, maintenance of the cap and surface water controls, surface and ground water monitoring, and 5-year site reviews.

Alternative 5b – Excavation and Disposal of Waste Rock Into Existing Mine Pits, Grading, Composite Soil Cap Using Offsite Highway Project and Commercial Materials, and Surface Water Controls

Cap impermeable layer:	Geomembrane liner	385/clay-offsite materials composite
Waste placement in:	Upper Ruby Gulch drainage	Existing mine pits
Protective cover and surface controls material:	Onsite spent ore	
	Offsite highway project rock	
	Offsite commercial materials	

Alternative 5b is similar to Alternative 5a except offsite materials for construction of the low permeability layer, protective layer, and surface water controls would be obtained from a highway construction project in the immediate vicinity of the Gilt Edge Mine site. The rock at the highway project has been tested and is not ARD-generating, but would require crushing and screening to obtain suitable construction materials. Since there would not be enough offsite highway rock, additional cap construction materials would be required from commercial sources. Growth media would be obtained from onsite sources as described in Alternative 5a. This alternative assumes that offsite highway project and commercial materials would meet specifications after crushing and screening and would not require amendments.

Alternative 5b would also include annual inspections, maintenance of the cap and surface water controls, surface and ground water monitoring, and 5-year site reviews.

Alternative 5c – Excavation and Disposal of Waste Rock Into Existing Mine Pits, Grading, Composite Soil Cap Using Offsite Commercial Materials, and Surface Water Controls

Cap impermeable layer:	Geomembrane liner	Clay-offsite materials composite
Waste placement In:	Upper Ruby Gulch drainage	Existing mine pits
Protective cover and surface controls material:	Onsite spent ore	
	Offsite highway project rock	
	Offsite commercial materials	

Alternative 5c is similar to Alternative 5a except offsite materials from commercial sources (e.g., quarry operations) would be used for construction of the cap and the surface water controls. Materials for the low-permeability layer, protective layer and the surface water controls would be hauled from preselected offsite commercial borrow pits. Growth media would be obtained from onsite sources as described in Alternative 5a. This alternative assumes that offsite materials would meet specifications and not require amendments.

Alternative 5c would also include annual inspections, maintenance of the cap and surface water controls, surface and ground water monitoring, and 5-year site reviews.

2.9.2 Common Elements and Distinguishing Features of Each Alternative

Alternatives 2a, 2b, 2c, 4a, 4b, and 4c use the upper Ruby Gulch drainage for disposal of waste rock excavated from the dump during regrading. Alternatives 3a, 3b, 3c, 5a, 5b, and 5c use the existing mine pits located in the Strawberry Creek watershed as a repository for disposal. Alternatives 2a, 3a, 4a, and 5a utilize onsite materials for construction of the cap. Alternatives 2b, 3b, 4b, and 5b use offsite highway project materials for construction of the cap. Alternatives 2c, 3c, 4c, and 5c use offsite materials from commercial sources for construction of the cap. Alternatives 2a, 2b, 2c, 3a, 3b, and 3c have a composite geomembrane cap. Alternatives 4a, 4b, 4c, 5a, 5b, and 5c have a composite soil cap. All alternatives utilize surface water controls and monitoring.

The distinguishing features of each alternative are discussed below.

Alternative 1 - No Action

Estimated Capital Cost:	\$0
Estimated Annual O&M Cost:	\$9,200

Under this alternative no remedial activities at the Ruby Dump would be conducted. There would be no change in the solids contaminant concentrations and generation of ARD because

no treatment, containment, or removal of mine waste is included in this alternative. Estimated costs are associated with surface and ground water monitoring and 5-year reviews.

Alternative 2a – Excavation and Disposal of Waste Rock Into the Upper Ruby Gulch Drainage, Grading, Composite Geomembrane Cap Using Onsite Materials, and Surface Water Controls

Estimated Capital Cost:	\$20,460,700
Estimated Annual O&M Cost:	\$31,100

In this alternative, waste rock removed from the Ruby Dump to achieve the desired slope would be used as fill in depressions in the Upper Ruby Gulch drainage immediately north of the waste rock dump to achieve required grades and to establish needed controls for surface water flow. A composite geomembrane cap and surface water controls would be constructed using onsite materials.

Alternative 2b – Excavation and Disposal of Waste Rock Into the Upper Ruby Gulch Drainage, Grading, Composite Geomembrane Cap Using Offsite Highway Project Materials, and Surface Water Controls

Estimated Capital Cost:	\$22,790,000
Estimated Annual O&M Cost:	\$31,100

Alternative 2b is similar to Alternative 2a except offsite materials for construction of the protective layer and surface water controls would be obtained from a highway construction project in the immediate vicinity of the Gilt Edge Mine site. Growth media would be obtained from onsite sources.

Alternative 2c – Excavation and Disposal of Waste Rock Into the Upper Ruby Gulch Drainage, Grading, Composite Geomembrane Cap Using Offsite Commercial Materials, and Surface Water Controls

Estimated Capital Cost:	\$28,315,600
Estimated Annual O&M Cost:	\$31,100

Alternative 2c is similar to Alternative 2a except offsite materials from commercial sources (e.g., quarry operations) would be used for construction of the cap and the surface water controls. Material for the protective layer and the surface water controls would be hauled from preselected offsite commercial borrow pits. Growth media would be obtained from onsite sources.

Alternative 3a – Excavation and Disposal of Waste Rock Using Existing Mine Pits, Grading, Composite Geomembrane Cap Using Onsite Materials, and Surface Water Controls

Estimated Capital Cost:	\$23,296,300
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Estimated Annual O&M Cost: \$31,100

In this alternative, waste rock that was to be used as fill for the depressions would instead be used as fill for onsite mine pits in the Strawberry Creek watershed. The surface water controls and the composite geomembrane cap would be constructed using onsite materials. Alternative 3a involves a greater cut volume of waste rock than Alternative 2a.

Alternative 3b – Excavation and Disposal of Waste Rock Using Existing Mine Pits, Grading, Composite Geomembrane Cap Using Offsite Highway Project Materials, and Surface Water Controls

Estimated Capital Cost: \$27,813,200

Estimated Annual O&M Cost: \$31,100

Alternative 3b is similar to Alternative 3a except offsite materials for construction of the protective layer and surface water controls would be obtained from a highway construction project in the immediate vicinity of the Gilt Edge Mine site. Growth media would be obtained from onsite sources.

Alternative 3c – Excavation and Disposal of Waste Rock Using Existing Mine Pits, Grading, Composite Geomembrane Cap Using Offsite Commercial Materials, and Surface Water Controls

Estimated Capital Cost: \$29,705,700

Estimated Annual O&M Cost: \$31,100

Alternative 3c is similar to Alternative 3a except offsite materials from commercial sources (e.g., quarry operations) would be used for construction of the cap and the surface water controls. Material for the protective layer and the surface water controls would be hauled from preselected offsite commercial borrow pits. Growth media would be obtained from onsite sources.

Alternative 4a – Excavation and Disposal of Waste Rock Into the Upper Ruby Gulch Drainage, Grading, Composite Soil Cap Using Onsite Materials, and Surface Water Controls

Estimated Capital Cost: \$22,387,300

Estimated Annual O&M Cost: \$31,100

Alternative 4a is similar to Alternative 2a except a 2-foot low permeability layer consisting of compacted spent oxide ore amended with 10 percent bentonite by weight would be used as the low permeability layer instead of an LDPE geomembrane. The protective layer consisting of limestone-amended spent oxide ore for this alternative would be 4 feet thick, 2 feet thicker than that used for Alternative 2a. The bentonite would be obtained from offsite commercial sources.

Alternative 4b – Excavation and Disposal of Waste Rock Into the Upper Ruby Gulch Drainage, Grading, Composite Soil Cap Using Offsite Highway Project and Commercial Materials, and Surface Water Controls

Estimated Capital Cost: \$44,421,700
Estimated Annual O&M Cost: \$31,100

Alternative 4b is similar to Alternative 4a except offsite materials for construction of the low permeability layer, protective layer, and surface water controls would be obtained from a highway construction project in the immediate vicinity of the Gilt Edge Mine site. Since there would not be enough offsite highway rock, additional cap construction materials would be required from commercial sources. Growth media would be obtained from onsite sources.

Alternative 4c – Excavation and Disposal of Waste Rock Into the Upper Ruby Gulch Drainage, Grading, Composite Soil Cap Using Offsite Commercial Materials, and Surface Water Controls

Estimated Capital Cost: \$47,603,100
Estimated Annual O&M Cost: \$31,100

Alternative 4c is similar to Alternative 4a except offsite materials from commercial sources (e.g., quarry operations) would be used for construction of the cap and the surface water controls. Materials for the low-permeability layer, protective layer, and the surface water controls would be hauled from preselected offsite commercial borrow pits. Growth media would be obtained from onsite sources.

Alternative 5a – Excavation and Disposal of Waste Rock Using Existing Mine Pits, Grading, Composite Soil Cap Using Onsite Materials, and Surface Water Controls

Estimated Capital Cost: \$24,869,000
Estimated Annual O&M Cost: \$31,100

Alternative 5a is similar to Alternative 3a except a 2-foot low permeability layer consisting of compacted spent oxide ore amended with 10 percent bentonite by weight would be used as the low permeability layer instead of an low density polyethylene geomembrane. The protective layer consisting of limestone-amended spent oxide ore for this alternative would be 4 feet thick, 2 feet thicker than that used for Alternative 3a. The bentonite would be obtained from offsite commercial sources.

Alternative 5b – Excavation and Disposal of Waste Rock Using Existing Mine Pits, Grading, Composite Soil Cap Using Offsite Highway Project and Commercial Materials, and Surface Water Controls

Estimated Capital Cost: \$42,369,000
Estimated Annual O&M Cost: \$31,100

Alternative 5b is similar to Alternative 5a except offsite materials for construction of the low permeability layer, protective layer, and surface water controls would be obtained from a highway construction project in the immediate vicinity of the Gilt Edge Mine site. Since there would not be enough offsite highway rock, additional cap construction materials would be required from commercial sources. Growth media would be obtained from onsite sources.

Alternative 5c – Excavation and Disposal of Waste Rock Using Existing Mine Pits, Grading, Composite Soil Cap Using Offsite Commercial Materials, and Surface Water Controls

Estimated Capital Cost:	\$45,448,600
Estimated Annual O&M Cost:	\$31,100

Alternative 5c is similar to Alternative 5a except offsite materials from commercial sources (e.g., quarry operations) would be used for construction of the cap and the surface water controls. Materials for the low-permeability layer, protective layer, and the surface water controls would be hauled from preselected offsite commercial borrow pits. Growth media would be obtained from onsite sources.

2.10 Comparative Analysis of Alternatives

This section describes the regulatory criteria against which remedy alternatives are evaluated as the basis for remedy selection.

2.10.1 Threshold Criteria

Alternatives must meet the first two Threshold Criteria, in order to be retained for further consideration.

- Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled.
- Compliance with ARARs addresses whether or not a remedy will meet all federal and state environmental laws and/or provide grounds for a waiver.

Alternative 1 - No Action fails to meet these criteria. There is also a possibility that Alternatives 2a, 3a, 4a, and 5a may fail to meet these criteria in the long-term.

2.10.1.1 Overall Protection of Human Health and the Environment

All of the alternatives, except the “no action” alternative, are protective of human health and the environment. Site risks are addressed by reducing exposure to site contaminants via the

airborne pathway, and by reducing the generation of ARD and movement and quantity of contaminants into the surface water and groundwater pathways.

Alternatives 2a, 3a, 4a and 5a would use spent ore from the heap leach pad for the protective layer and the surface water controls over the liner. Even though the spent ore would be amended with limestone to mitigate the potential for the heap leach pad material from becoming ARD-generating or having other secondary metals releases, the potential for such releases short-term and long-term would still exist. The alternatives that would import uncontaminated off-site materials for the cap cover, would have no potential for long-term secondary contaminant releases.

2.10.1.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Compliance with ARARs addresses whether a remedy will meet all the applicable or relevant and appropriate requirements of Federal and State environmental statutes. The Feasibility Study evaluation concluded that, except for the No Action alternative, all of the cleanup alternatives could be engineered to achieve compliance with ARARs. Even so, the uncertainties associated with the long-term effectiveness and permanence of some alternatives, translates to similar uncertainties about the long-term assurance of such remedies to sustain permanent ARARs compliance over the long-term.

Alternatives 3a, 3b, 3c, 5a, 5b and 5c, which would place contaminated materials as fill into mine pits in the Strawberry Creek drainage (which are in highly faulted and fractured bedrock zones that are also in communication with the regional groundwater system) could result in contaminated leachates being secondarily released into groundwater and surface waters, potentially causing non-compliance with water quality standards in Strawberry Creek. Likewise, Alternatives 2a, 3a, 4a and 5a which would utilize amended rock materials from the heap leach pad as cover material over the geomembrane liner, could have long-term secondary releases of metal compounds from the cap cover materials into Ruby Gulch, potentially resulting in exceedances of water quality standards in Bear Butte Creek. Consequently, those Alternatives (2b, 2c, and 4c) that maintain the repository within the Ruby Gulch (which does not have an active groundwater system like Strawberry Creek) and which would utilize “clean” cover materials from off-site sources, provide the greatest assurance of long-term ARARs compliance.

Appendix A summarizes the ARARs compliance status of this action and documents ARARs compliance for the selected remedy.

2.10.2 Primary Balancing Criteria

Alternatives which meet the threshold criteria are then evaluated against the following five criteria known as the Primary Balancing Criteria:

- Long-term effectiveness and permanence refers to the ability of a remedy to provide reliable protection of human health and the environment over time.
- Reduction of toxicity, mobility, or volume through treatment refers to the preference for a remedy that reduces exposure and risk, the movement of contaminants, or the quantity of contaminants at the site through treatment.
- Short-term effectiveness addresses the period of time needed to complete the remedy and any adverse effects to human health and the environment that may be caused during the construction and implementation of the remedy.
- Implementability refers to the technical and administrative feasibility of the remedy, including the availability of materials and services needed to carry out the remedy and coordination of federal, state, and local governments to work together to clean up the site.
- Cost evaluates the estimated capital and operation and maintenance costs of each alternative in comparison to other, equally protective measures.

2.10.2.1 Long Term Effectiveness and Permanence

All of the alternatives, except the “no action” alternative provide varying degrees of long term effectiveness and permanence by reducing the risks through relocation of waste rock and capping of the dump materials. While Alternatives 2a, 3a, 4a, and 5a would utilize amendments intended to chemically-buffer and stabilize the heap-leach pad rock materials against future metal releases and migration, there is a concern that such amendments cannot be guaranteed to prevent future secondary releases, and therefore may fail to meet these criteria in the long-term. Alternatives 2b, 2c, 4b, and 4c provide the greatest long-term effectiveness by using imported materials for the cap cover and surface water controls which have no future possibility of secondary releases of contaminants. Alternatives 2b and 2c utilize a geomembrane liner which is not susceptible to the long-term potential for physical and chemical degradation that can potentially occur with geocomposite caps constructed of clay/earth components. Alternatives 3a, 3b, 3c, 5a, 5b and 5c, which would utilize the Dakota Maid and Sunday pits, have the potential to place waste rock into areas known to have active groundwater communication and flow paths into alluvial and bedrock aquifers of the Strawberry Creek drainage. Alternatives 2a, 2b, 2c, 4a, 4b, and 4c maintain the repository location within Ruby Gulch, which has less groundwater communication and potential for releases to alluvial and bedrock aquifers.

2.10.2.2 Reduction of Toxicity, Mobility, or Volume Through Treatment

The EPA Remedial Investigation/Feasibility Study (RI/FS) guidance (EPA 1988) states that reduction of toxicity, mobility or volume is only accomplished by treatment. Because surface water controls, source controls, and waste relocation are not considered treatment, all of the alternatives have low effectiveness in the reduction of toxicity, mobility or volume of metals

contamination in the primary source material. However, an impermeable cap reduces the amount of water and air contacting the waste rock. This then limits the chemical reactions that form the ARD (secondary source). In this way the cap reduces the volume and mobility of contaminants, although not through direct treatment.

2.10.2.3 Short-Term Effectiveness

This criterion addresses (1) short-term risks to the community, (2) potential impacts to workers during the action, (3) potential environmental impacts of the remedial action and the reliability of protective mitigation measures, and (4) the time required for implementation of the remedy.

Impacts to community. For the alternatives utilizing Highway 385 project materials, SDDOT anticipates closing Highway 385 to through traffic during construction, thereby eliminating the potential for accidents to public drivers on the highway. Alternatives that require use of commercial fill materials being truck-hauled from regional sources over highways would increase the likelihood of traffic accidents. Risks of vehicle accidents to residents along the Gilt Edge Road from truck traffic is higher than if alternatives using on-site materials were implemented. Under the alternatives involving Highway 385 rock hauling, SDDOT will have informational safety briefings for the nearby residents. With respect to resident's concerns about wind-blown dust, impacts will be mitigated by magnesium chloride dust-suppression during truck-hauling of materials into the site.

Impacts to workers. The only difference for worker safety concerns between the alternatives regards construction using heap leach pad rock materials versus clean off-site materials. Normal dust-suppression for construction hauling would be implemented for all alternatives. However, if lapses to such mitigation efforts occurred, the alternatives using heap leach pad materials could result in exposures to dusts containing metals that are present in the heap leach rock materials.

Environmental protection mitigation. Remedial activities under all alternatives would be within the confines of the existing site and watersheds. Runoff from all remedy construction areas would be under storm discharge controls to prevent off-site releases and the mitigation measures would be similar and comparable for all alternatives.

Remedy timing. The period of construction for alternatives using either the heap leach pad material or the Highway 385 rock would be comparable. Using heap leach pad rock would have shorter haul distances and times because of its closer proximity to the waste rock dump, but additional time would be required for incorporating lime amendments. Importing Highway 385 rock (the closest offsite material) increases haul distances/times, but will not add to the overall project duration since no amendments will be needed. Other offsite commercially-available cover materials would have to come from quarry-sources in the region and haul distances and times would be significantly increased, potentially extending the project duration an additional construction season.

2.10.2.4 Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are considered.

Alternatives 2a and 2b are most easily (highly) implementable. Onsite or nearby materials would be used for the cap, reducing the distance to haul construction materials and improving the coordination of traffic control and construction logistics. Alternative 2a would utilize onsite material (amended heap leach pad rock materials) and 2b would use nearby highway project rock, each being readily achieved with proper planning and local resident traffic coordination. In addition, limiting the repository location to the Upper Ruby Gulch drainage and avoiding mine pit backfills, reduces the amount of truck traffic across the site, improving onsite safety and construction management. Alternatives 2a and 2b (as well as 2c, 3a, 3b, and 3c) utilize a composite geomembrane cap, which is easier to implement and reliably construct than a composite soil cap. A composite soil cap generally takes longer to construct and requires additional construction equipment. Construction of a composite soil cap could involve a longer construction period, resulting in adverse impacts due to factors such as weather, labor shortages, and equipment failure or unavailability, any of which could adversely affect project schedule and budget.

Alternatives 2c, 3a, 3b, and 4a would require a greater level of effort (moderate) to implement. Alternative 2c uses the Upper Ruby Gulch drainage but would require the transportation of large quantities of suitable cap construction material from reliable but distant offsite commercial borrow pits, resulting in higher likelihood of traffic-related effects (including accidents) on construction schedules. Alternatives 3a and 3b are rated moderate because they would require truck haulage across the site into mine pits. Even though Alternative 4a uses onsite materials, it involves a composite soil cap which would require significant amendments with offsite materials.

Alternatives 3c, 4b, 4c, 5a, 5b and 5c would require the greatest level of effort (low) to implement. Alternative 3c has a geomembrane cap but uses the mine pits and offsite commercial materials. Alternatives 4b and 4c use a composite soil cap and offsite commercial borrow pits. Alternatives 5a, 5b, and 5c use both the composite soil cap and mine pits.

2.10.2.5 Cost

Present value costs (projected over 30 years) for each alternative are presented in Section 2.10.4, Table 2.

Alternatives 2a and 2b, \$20,880,300 and \$23,209,600 respectively, are the least costly to implement because on-site or nearby materials would be used for the cap.

2.10.3 Modifying Criteria

The last two criteria are Modifying Criteria and are used to evaluate the technical and administrative concerns the State and the public may have regarding each alternative. Consideration of these two criteria may cause EPA to modify its choice of cleanup strategy. Accordingly, these criteria are evaluated after public comments are received on the Proposed Plan.

- State acceptance indicates whether the state agrees with, opposes, or has no comment on the preferred alternative. No written comments were received from any State agencies other than DENR. DENR's signature herein indicates the State's concurrence on this Selected Remedy.
- Community acceptance includes determining which components of the alternatives interested persons in the community support, have reservations about, or oppose. Commentors at the public meeting and e-mails received indicated support for the proposed remedy; however, several people expressed concerns about traffic and dust impacts. Any of the remedies that would utilize off-site cover materials (385-rock or commercial sources) would raise these issues. EPA has discussed these effects on the local community with SD Department of Transportation to determine ways to minimize the impacts to the local community of rock hauling from the Highway 385 expansion project.

Dust control. Dust suppression options include watering of roadways and/or application of the commonly-used and environmentally-benign dust-suppression additive magnesium chloride. Road watering, if diligently applied, is effective but also can result in more traffic from required watering trucks and sometimes slippery roads. SDDOT has advised that the preferred approach would be to incorporate magnesium chloride into the road surface prior to hauling, with several application amendments during the project.

Truck traffic density. To import off-site materials, EPA recognizes that the number of trucks trips will be in the thousands. The residents living along the Gilt Edge Road will be most impacted by traffic during those months when truck density will be relatively heavy and precautions for their safety needs to be addressed. EPA and SDDOT want to assure the safety of people using the road, and intend to meet with local residents to develop plans for road access and transit that accommodate their safety concerns. EPA also notes that remedies using off-site commercial material sources would result in the same number of truck trips, but would be traversing much longer highway distances than the Highway 385 project, thereby increasing the overall risk of traffic accidents.

2.10.4 Summary of Detailed Analysis of Alternatives

The following table summarizes the strengths and weaknesses of the alternatives as compared against the Threshold and Primary Balancing criteria of the NCP regulations.

Alternative 2b stands out as the remedy with the highest cumulative rating for achieving the overall objectives of the criteria. Only those alternatives that place the repository in the Ruby Gulch drainage (2b, 2c, 4b, 4c) provide high ratings for the criterion of long-term effectiveness and permanence. Only Alternatives 2b and 2c provide a high implementability rating; furthermore their costs are approximately one-half of Alternatives 4b and 4c.

Summary of Detailed Analysis of Alternatives

<i>Alternative</i>	<i>Overall Protection of Human Health and the Environment</i>	<i>Compliance with ARARs</i>	<i>Long-Term Effectiveness and Permanence</i>	<i>Reduction of Toxicity, Mobility or Volume Through Treatment</i>	<i>Short-Term Effectiveness</i>	<i>Implementability</i>	<i>Present Value Cost*</i>
1 - No Action	None	None	None	None	None	High	\$147,800
2a - RGD/Geomembrane/HLP	Moderate	High	Moderate	Low	Moderate	High	\$20,880,300
2b - RGD/Geomembrane/385	High	High	High	Low	Moderate	High	\$23,209,600
2c - RGD/Geomembrane/Com	Moderate	High	High	Low	Low	Moderate	\$28,735,200
3a - MP/Geomembrane/HLP	Moderate	High	Low	Low	Moderate	Moderate	\$23,715,900
3b - MP/Geomembrane/385	Moderate	High	Moderate	Low	Moderate	Moderate	\$28,232,800
3c - MP/Geomembrane/Com	Low	High	Moderate	Low	Low	Low	\$30,125,300
4a - RGD/Soil Composite/HLP	Low	High	Moderate	Low	Low	Moderate	\$22,806,900
4b - RGD/Soil Composite/385	Moderate	High	High	Low	Low	Low	\$44,841,300
4c - RGD/Soil Composite/Com	Moderate	High	High	Low	Low	Low	\$48,022,700
5a - MP/Soil Composite/HLP	Low	High	Low	Low	Low	Low	\$25,288,600
5b - MP/Soil Composite/385	Low	High	Moderate	Low	Low	Low	\$42,788,600
5c - MP/Soil Composite/Com	Low	High	Moderate	Low	Low	Low	\$45,868,200

* For estimating costs during the focused feasibility study, remedial action projects typically involve construction costs that are expended at the beginning of the project (e.g., capital cost) and costs in subsequent years that are required to implement and maintain the remedy after the initial construction period (e.g., annual O&M costs, periodic costs). Present value analysis is a method to evaluate expenditures (including both capital and O&M) which occur over different time periods. This standard methodology allows for cost comparisons of different remedial alternatives on a basis of a single cost figure for each alternative. Present value cost for each alternative is presented below.

2.11 Selected Remedy

The objectives set out for this interim remedial action were to:

- control erosion of mine waste contaminants into Ruby Gulch and Bear Butte Creek
- reduce formation and volume of ARD
- reduce leaching and migration of contaminants from mine waste into surface water, and
- reduce leaching and migration of contaminants from mine waste that may enter groundwater

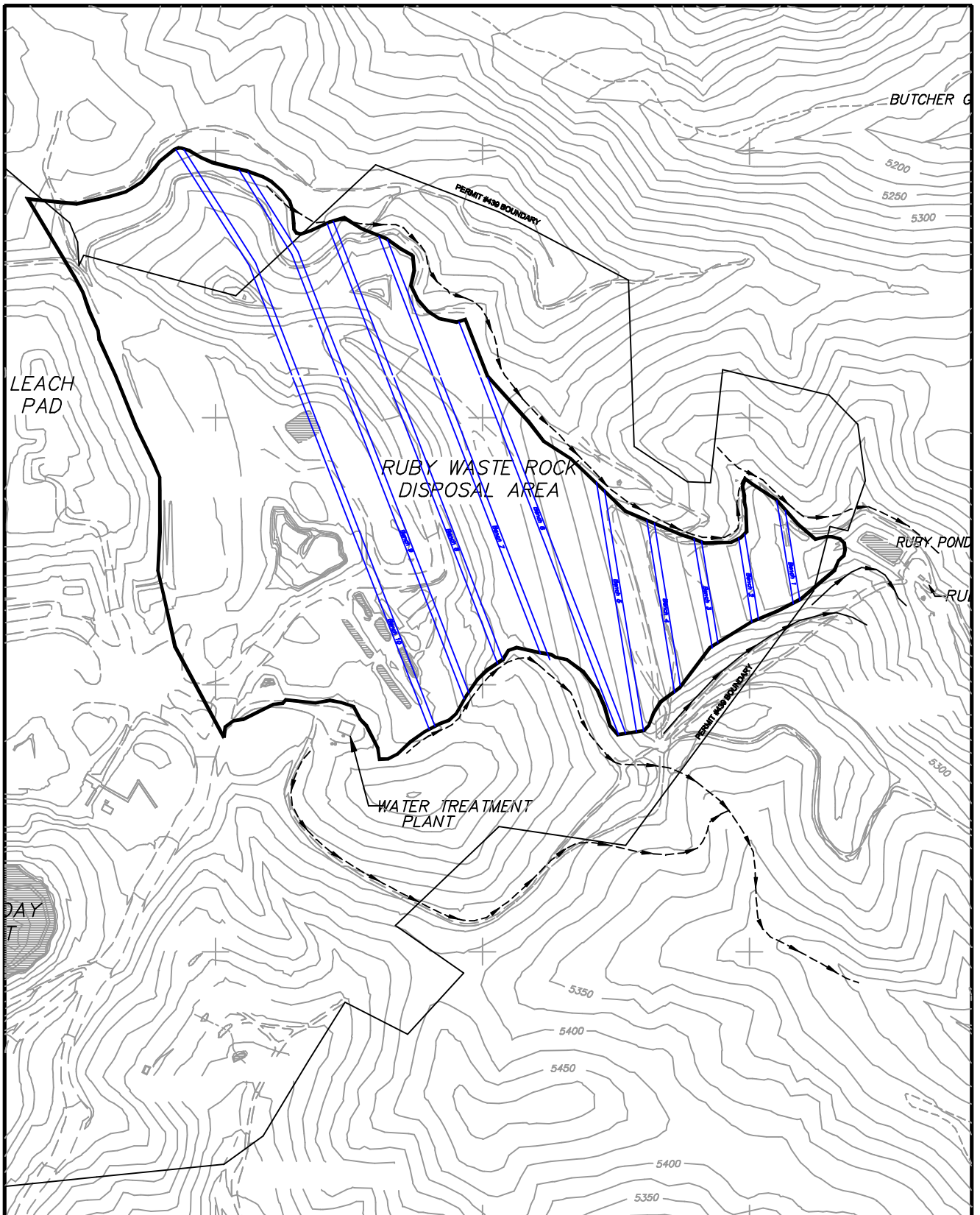
The remedy selected by EPA and SDDENR for this interim remedial action is Alternative 2b (see Figure 2):



- regrading of waste rock, including placement in the upper Ruby Gulch drainage;
- construction of a composite cap using a geomembrane liner,
- installation of lateral drainage structures to limit erosion and convey runoff,
- construction of a protective layer for the liner and surface water controls using materials consisting of the Highway 385 project rock and growth materials from onsite sources, and
- construction of surface water run-on diversions.

This remedy achieves the following:

- maintains all of the contaminated waste rock in a single repository location in Ruby Gulch (thereby best achieving the RAO of reducing migration of contaminants from mine waste into groundwater),
- utilizes a polyethylene geomembrane liner having the least potential for long-term failure (thereby best achieving the RAOs of reducing formation and volume of ARD and leaching and migration of contaminants from mine waste into surface and groundwater),
- most effectively reestablishes a stable and protective landscape and drainage system in upper Ruby Gulch (thereby best achieving the RAOs of controlling potential erosion and reducing migration of mine waste contaminants into surface water),
- uses benign rock cover materials from off-site that have no long-term risk of secondary contaminant releases (thereby best achieving the RAO of reducing leaching and migration of contaminants into surface water).

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Gilt Edge Mine Lawrence County, South Dakota		Alternative 2b Selected Remedy Waste Rock Repository, Cap, and Surface Water Controls	Figure No. 2
 			06/01

2.12 Statutory Determinations

Based on the information currently available, EPA and SDDENR believe the selected remedy meets the threshold criteria and provides the best balance of all alternatives with respect to NCP Threshold Criteria, Primary Balancing Criteria, and Modifying Criteria. EPA and SDDENR expect the selected remedy to satisfy the following statutory requirements of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121(b):

- Be protective of human health and the environment
- Comply with ARARs
- Be cost-effective
- Utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum practical extent
- Satisfy the preference for treatment as a principal element or explain why the preference for treatment will not be met.

2.12.1 Protection of Human Health and the Environment

The selected remedy is protective of human health and the environment because it maintains the location of the Ruby Gulch Waste Rock Dump in the upper Ruby Gulch drainage and within Gilt Edge Mine property, and provides effective containment of the mine waste through construction of the composite geomembrane cap. The existing risk of ARD formation will be reduced or eliminated, thereby protecting human health and the environment. The Selected Remedy will not pose unacceptable short term risks during implementation and provides long-term effectiveness and permanence.

2.12.2 Compliance with Applicable or Relevant and Appropriate Requirements

The Selected Remedy will comply with all ARARs as outlined in Appendix A.

2.12.3 Cost-Effectiveness

EPA and SDDENR have determined that the Selected Remedy is cost effective in mitigating the principal risks posed by contaminated mine wastes. Section 300.430(f)(ii)(D) of the NCP requires evaluation of cost effectiveness. Overall effectiveness is determined by the following three balancing criteria: long-term effectiveness and permanence; reduction of toxicity, mobility, and volume through treatment; and short-term effectiveness. Overall effectiveness is then compared to cost to ensure that the remedy is cost effective. The Selected Remedy meets the criteria and provides the best overall effectiveness in proportion to its cost. The estimated present value cost for the Selected Remedy is \$23,209,600.

2.12.4 Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable

In the feasibility study EPA evaluated potentially applicable remediation and process options involving physical/chemical, thermal and resource utilization technologies. These technologies were screened out of further detailed analyses due to technical infeasibility for site application, low implementability, and/or excessively high cost. The only aspects of treatment that were retained for detailed analysis were for neutralization of cap cover materials and ARD water treatment. Containment options were found to provide the best balance of tradeoffs for long-term effectiveness and permanence, and reduction of toxicity, mobility and volume of contaminants. The Selected Remedy represents the maximum extent to which permanence and treatment can be practicably utilized at the Site.

2.12.5 Preference for Treatment as a Principal Element

Due to the volume of waste rock present onsite, it is impractical to directly treat the contaminated waste rather than use onsite containment practices. However, the construction of the Selected Remedy does indirectly accomplish one of the objectives of treatment, which is reductions in volumes and concentrations of secondary source leachate contaminants.

2.12.6 Five-Year Review Requirements

Alternative 2b would also include annual inspections, maintenance of the cap and surface water controls, surface and ground water monitoring, and 5-year site reviews as required by the NCP.

2.13 References

Bureau of Reclamation (BOR). 2000. *Closure Plan for Gilt Edge Mine, Lawrence County, South Dakota*. U.S. Department of Interior, Bureau of Reclamation, Technical Services Center, Denver, Colorado. February 11.

CDM Federal Programs Corporation (for EPA). March 2001. Final Focused Feasibility Study for Gilt Edge Mine Site; Ruby Dump and Gulch Operable Unit 3, Lawrence County, South Dakota.

Koryak, M. 1999. Origins and Ecosystem Degradation Impacts of Acid Mine Drainage, U.S. Army Corps. Of Engineers. [http// www.orp-wc.usace.army.mil/misc/AMD_Impacts.html](http://www.orp-wc.usace.army.mil/misc/AMD_Impacts.html)

Robertson GeoConsultants Inc. (for EPA). August 2000. Geochemical Field Reconnaissance Survey of the Gilt Edge Mine, SD.

URS Operating Services (UOS). 1999. *Analytical Results Report for Site Inspection for Gilt Edge Mine, Lead, South Dakota*. July 12.

U.S. Geological Survey (USGS). 1971. 7.5 minute - Series Topographic Quadrangle Map of Deadwood, South Dakota. 1:24,000 scale.

U.S. Environmental Protection Agency (EPA). 2000. Hazard Ranking System Package. May.

Part 3

Responsiveness Summary

This responsiveness summary provides responses to comments received by the United States Environmental Protection Agency (EPA) regarding the proposed plan for the Ruby Gulch Waste Rock Repository at the Gilt Edge Mine NPL Site. The proposed plan was issued on April 27, 2001. EPA received three comment letters or e-mail messages directly pertaining to the solicitation for comments. Questions and comments on the proposed plan were received at the May 2, 2001 and also from e-mails sent to EPA. The e-mail correspondences and the public meeting transcript are on file in the administrative record for the site which is available for review at the Hearst Public Library, 315 Main Street, Lead, South Dakota 57754 and at EPA Superfund Records Center, 999 18th Street, 3rd Floor, South Tower, Denver, Colorado 80202.

EPA has given full consideration to the questions and comments posed in the email correspondences and at the May 23rd public meeting; the following responsiveness summary has been prepared to more clearly address the questions and comments in finalizing the Record of Decision (ROD) for Operable Unit 3 (OU3), Ruby Gulch Waste Rock Repository and Cap.

Public Meeting Comments:

Text below paraphrases the commentor's and responder's questions and answers.

Commentor

Referring to the presentation overhead-slides, what is the cost of the preferred alternative?

EPA Response

The estimated present value cost of the preferred alternative is \$23,209,600.

Commentor

What would be the best-case scenario for a schedule for this project-start and end-dates?

EPA Response

All of work to cap the Ruby Dump is contingent on funds becoming available for the project. The following schedule assumes funding is available, and U.S. Bureau of Reclamation (Reclamation) continues as the general contractor for the project under an Inter-Agency Agreement with EPA. Base-grade earth moving that would be needed under any remedy has already been started by Reclamation. Under this ROD, base-grade construction would continue. Over the fall and winter 2001-2002 months, engineers will complete final design and prepare construction bid packages. EPA anticipates the project may be designed, bid and constructed in phases to ensure timely field implementation. S.D. Department of Transportation expects rock excavating on the 385 project to commence about May 2002. EPA wants the geomembrane liner and terrace drains installation to begin in April-May 2002. This will allow placement of rock materials on the liner to coincide with the SDDOT project. Completion of the liner and rock/soil cover should be done by late-Fall 2002, with re-vegetation work being completed in Spring 2003.

Commentor(s)

EPA was asked about the availability of funding and the consequence of no funding.

EPA Response

As of the time of the comment period, EPA Region 8 has submitted requests to headquarters for allocation of full-funding for the project. The full-funding request is pending, and EPA Region 8 expects incremental funding that should allow the project to be started. In the event funding is unavailable, at least increments of the project would be delayed– potentially delaying incremental reductions in site water treatment requirements and costs. However, EPA Region 8 would try to continue to work with SDDOT to obtain the Highway 385 rock materials in order to realize the substantial cost-savings from using that material rather than an alternative source of off-site clean fill which would have to be obtained from sources more distant.

Commentor

Absent funding, concern was expressed about EPA's ability to keep abreast of precipitation events and water treatment needs.

EPA Response

Water treatment needs should not be a growing problem with regards to off-site releases. The Ruby Cap project would reduce treatment requirements by approximately 30 million gallons per year, but there is sufficient short- and interim-term storage capacity at the site to accommodate contaminated water.

Commentor(s)

Concerns were expressed (particularly owners of property along the Gilt Edge Mine Road) related to increased traffic resulting from trucks hauling 500,000 cubic yards of rock into the site, specifically asking about safety, dust impacts to people with asthmatic conditions, asphalt-capping or graveling the road as cover/maintenance material, and final repair and road conditions at the end of the project.

EPA Response

Truck-hauling density: SDDOT anticipates that their contractor will use over-the-road type trucks for rock hauling, rather than the larger rock-trucks sometimes seen on very large excavation projects. SDDOT calculated truck trips, and estimates a truck passing by every two minutes with large gaps between each truck. Compared to an urban area, this is not a significant amount of traffic.

Road cover material and maintenance during project: After the public meeting, SDDOT determined that it will be using the asphalt cuttings off of existing Highway 385 as part of the base-grade material for the rebuilt Highway 385 road bed, and consequently will not be available for use on the Gilt Edge Road. SDDOT will use locally-available quarry gravel for roadbase and maintenance needs during the project; these activities will be part of the SDDOT contract let for the project.

Dust abatement for nearby residences: According to SDDOT, magnesium chloride is a common and widely-used additive for road dust suppression in the region and is also used for snow and ice removal on highways and city streets. It will be incorporated into the top several inches of the Gilt Edge road prior to startup of rock hauling, and will be amended with additional applications several times during the project duration. Incidentally, the Lawrence

County road department also advised SDDOT that the Gilt Edge Road has been treated with magnesium chloride for the past 10 years without any detrimental effects.

Final repair and road condition: SDDOT anticipates adding gravel to the road during the project, and has committed to leave it in as good or better shape than at the project start.

Commentor

Regarding the proposed use of adjacent Forest Service property, one commentor asked about the Forest Service position on such use of the land.

Response to Commentor

The USDA Forest Service did not have a problem with such a use for these relatively small and isolated land holdings, one containing several depressions located north of an adjacent to the Ruby waste-rock dump, and several very small tracts on the diversion channel routes. Earlier this year, the State of South Dakota purchased these parcels from the Forest Service so that the areas could be used for the repository and the diversions. This purchase was made under a law called the Small Tracts Act, which allows the Forest Service to dispose of land for certain purposes. The state will continue to hold title to these lands after remediation at the site is completed.

Commentor

Is this cap going just on the dump or is it going also on the site of the last mine area?

EPA Response

This action only addresses the Ruby Gulch waste rock, and the cap proposed for this action is only for the Ruby Waste-Rock Repository. Caps, if needed, for other areas of the site will be addressed in subsequent decisions.

Commentor

In regards to the waste rock dump, how much of that dump is oxides and how much of that is sulfides; in addition to that, are the sulfides capping (overlying) the oxides?

EPA Response

There is not precise information readily available about how much is sulfide versus oxides; however, remedial information indicates that a substantial amount of the dump material is sulfides. The oxides and sulfide rocks were sufficiently mixed during dumping to cause the entire mass to essentially be acid-generating and require remediation.

Commentor

Is anybody being forced off their land for this operation?

EPA Response

Strictly speaking, no, because all the land at this mine site was either previously purchased by the mining company or was under lease arrangements for mining and reclamation.

Commentor

Several commentors were concerned that the cap might slide off the hill in heavy rains and asked about the stability of the "rubber" liner and cap, the nature of the base beneath the liner, and whether the cap would be anchored.

EPA Response

The engineering team at the Bureau of Reclamation completed stability tests in two independent laboratories testing the stability of the liner-cap on a steep slope. In the laboratory the cap was saturated and hydrostatically-loaded to test failure. It remained stable at a 3:1 slope steeper than proposed; however, an independent consultant specialized in liner-cap design and construction recommended conservative placement at 3.5:1 grade. The base material beneath the geomembrane liner will be rock from the Heap Leach Pad crushed-graded to 3/4inch-minus so that no sharp, angular rocks will puncture the 80-mil low density polyethylene liner material.

Commentor

Will this cap have to have some kind of protocol for annual maintenance?

EPA Response

There will be an operations and maintenance plan prepared as part of final design. After initial cap construction, EPA pay considerable attention to it. The State will have to prepare a long-term operations and maintenance plan, but EPA will fund that activity for the initial 10 years. After that initial period, the State will be responsible for the long-term O & M plan to assure the long-term integrity of the remedy. EPA conducts 5-year reviews to assure that long-term O&M and remedy integrity are being maintained.

Written (e-mail) Correspondences:

Written Comment No. 1

Thank you for the detailed report and proposals for remediation of the Acid Rock Drainage at the Brohm Mine site. It seems almost too serendipitous that a Highway 385 improvement project would be ongoing at the very time you will need clean fill material for this site reclamation! I hope the Highway Department does not ask that you purchase this material as they excavate for road work! At any rate, I can agree that your Preferred Alternative, 2b, appears as best suited for the intended purpose.

EPA Response

EPA will not have to purchase any of the materials from the SDDOT project. EPA will only pay any extra costs associated with hauling the materials to the Gilt Edge NPL site.

Written Comment No. 2

I live a half mile off highway 385 just off Gilt Edge Road. I am very concerned about the traffic on Gilt Edge Road. It seems the road is in worse condition now than it ever has been since we have lived here. We moved on our property in 1996. I ride my motorcycle to work in the summer (weather permitting), it gets 50 miles to the gallon verses 30 miles with my car. I count on this savings to help make ends meet in other areas. I work in Rapid City, so I drive 100 miles round trip each day and the difference in mileage adds up. Now I understand that there are going to be trucks hauling 500,000 cubic ft. of ground up blacktop to put on the waste rock pile. I am very concerned about what condition the road will be in with all that truck traffic. Perhaps some of the blacktop should be put on Gilt Edge Road so it will stand up a little better. I am also concerned about our well. It is 300 feet deep. Now that you have the mine water

cleaned up, it would give me great peace of mind if we could send in a sample of well water to be tested for chemicals.

EPA Response

There will be approximately 500,000 cubic yards of rock and earth materials transported from the SDDOT project to the Gilt Edge site. Hauling operations will include road maintenance and/or upgrading to keep the road in current or better conditions. DOT will not be using any of the Highway 385 blacktop as road material, but will add quarry gravel to the existing road. SDDOT has advised that water wells of adjacent property owners who are concerned will be tested upon request.

Written Comment No. 3

We are the owners of the King Solomon 1399 mining claim, 30 acres located in Lawrence County. I am sorry that I did not receive the notification in time to attend the meeting, it was misdirected in the mail, and I received it Saturday, May 26, 2001. I have read and understand the proposed project and would like to express our concerns. It our understanding that +/- 30,000 dump truck loads of dirt and rock will be hauled through our property on the Gilt Edge Road. This will create a lot of dust and a lot of wear and tear on the already overused road. We would at minimum like to see a permanent dust coating or ideally asphalt. Possibly the asphalt from the 385 project would be an inexpensive source. We are also concerned about the waste water, we intend to place a well on the property, and would like to be assured that this water will not be contaminated. Many of our family members have different bronchial ailments and we would like assurances that the air quality will not be compromised by the dust and debris in the air.

EPA Response

As noted above, SDDOT will be utilizing quarry gravel as road surfacing material. For dust suppression, magnesium chloride is a common and widely-used additive for road dust suppression in the region and is also used for snow and ice removal on highways and city streets. It will be incorporated into the top several inches of the Gilt Edge road prior to startup of rock hauling, and will be amended with additional applications during the project duration. This is to prevent off-road dust from blowing to nearby residences, which might unreasonably compromise their air quality. The Lawrence County road department has also advised SDDOT that the Gilt Edge Road has been treated with magnesium chloride for the past 10 years without any detrimental effects. SDDOT has advised that water wells of adjacent property owners who are concerned will be tested upon request.

Written Comment No. 4

After looking over the proposal plan for Ruby Gulch our organization agrees with you with respect to your choice of 'Alternative 2b' for correcting the problem. My only questions are: How much Forest Service land will be used for waste rock disposal and will this area be replanted with local and natural materials? Thank you for sending the proposal for our consideration.

EPA Response

Approximately 7-10 acres of additional land (former Forest Service property) will be utilized as part of the waste rock repository. EPA anticipates that the final cap surface will include vegetation that is compatible with the surrounding landscapes.

Appendix A - Analysis of ARARs

APPENDIX A

SUMMARY OF FEDERAL AND STATE ARARs COMPLIANCE OPERABLE UNIT 3 GILT EDGE MINE NPL SITE

Statue and Regulatory Citation	ARAR Determination	Description	Comment
FEDERAL - Chemical Specific			
Safe Drinking Water Act, 42 U.S.C. § 300f, et seq., National Primary and Secondary Drinking Water Regulations 40 CFR 141 and 143	Relevant and Appropriate	The National Primary and Secondary Drinking Water Regulations (40 CFR 141 and 143) establish maximum contaminant levels (MCLs) for chemicals in drinking water distributed in public water systems. The primary standards are enforceable in South Dakota under the South Dakota Constitutional Law (SDCL) § 34A-3A-1, et seq., and Administrative Rules of South Dakota (ARSD) § 74:04:05. Safe Drinking Water Act MCLs are relevant and appropriate to a Gilt Edge Mine OU3 remedial action because the aquifers found beneath the Gilt Edge Mine OU3 are currently a source for public water supplies. These standards may be applicable in the future should EPA detect an exceedence at a public water outlet.	Even though the surface waters, recharge areas, and aquifers in and near the areas of the Gilt Edge Mine are part of the watershed sources for public water supplies, the action of this Interim ROD does <u>not directly</u> address groundwater remediation. Precipitation onto the Ruby Gulch Waste Rock Dump infiltrates and discharges to surface and local groundwater as metal-laden acid rock drainage. The contaminated waters (estimated at 30 million gallons per year) are intercepted at the toe of the dump for treatment. The installation of the cap and cover will (1) prevent precipitation from becoming contaminated allowing clean runoff to again flow freely into the receiving waters, and (2) thereby reduce by 30 millions per year the quantity of contaminated waters requiring treatment. Furthermore, by reducing generation of this quantity of contaminated waters, the ability of the water management system at the site (pumps, pipelines, and water treatment) to protect against the risk of offsite releases into the regional groundwater supplies is improved substantially.

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Statute and Regulatory Citation	ARAR Determination	Description	Comment
Federal Surface Water Quality Requirements, Clean Water Act 33 U.S.C. §§ 1251, et seq.	Applicable	As provided under Section 303 of the Clean Water Act, 33 United States Code (U.S.C.) § 1313, the State of South Dakota has promulgated water quality standards.	All contaminated waters emanating from the Ruby Gulch Waste Rock Dump are intercepted and treated as part of Operable Unit 2 - Interim Water Treatment pursuant to Federal and State Clean Water Act requirements. The installation of the cap and cover will prevent further contact of precipitation with ARD-generating source materials, thereby allowing runoff of uncontaminated waters from the OU3 capped area to be re-established into receiving waters. The remedial design components such as revegetated cover and other water management controls will address any applicable stream discharge criteria (ie TSS/TDS).
National Ambient Air Quality Standards 40 CFR 50.6; (PM-10); 40 CFR 50.7 (PM 2.5); and 40 CFR 50.12 (Lead).	Relevant and Appropriate	These provisions establish standards for PM-10, PM 2.5, and lead emissions to air.	National ambient air quality standards (NAAQS) are implemented through the New Source Review Program and State Implementation Plans (SIPs). South Dakota has adopted the federal standards for particulate and lead emissions. The Federal New Source Review program addresses only major sources. Emissions associated with proposed remedial action in OU3 will be limited to fugitive dust emissions associated with earth moving activities during construction, which will occur only in isolated areas over a short period of time and will have dust control mitigation measures implemented.

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SUMMARY OF FEDERAL AND STATE ARARs COMPLIANCE OPERABLE UNIT 3 GILT EDGE MINE NPL SITE

Statute and Regulatory Citation	ARAR Determination	Description	Comment
STATE OF SOUTH DAKOTA - Chemical Specific			
Groundwater Quality Standards ARSD § 74:54:01	Applicable	This provision ARSD § 74:54:01 states that existing and future beneficial uses of groundwater shall be maintained and protected. Waters of the state in which ambient water quality is better than the minimum levels prescribed shall be maintained and protected at the better water quality. Groundwater that has an ambient concentration of 10,000 mg/L or less total dissolved solids (TDS) is classified as having the beneficial use of drinking water supplies, suitable for human consumption. Groundwater beneath the Gilt Edge site meets these requirements.	This action of this Interim ROD does <u>not directly</u> address groundwater remediation. All contaminated waters emanating from the Ruby Gulch Waste Rock Dump are intercepted and treated as part of Operable Unit 2 - Interim Water Treatment. The installation of the cap and cover will prevent further contact of precipitation with ARD-generating source materials, thereby allowing runoff of uncontaminated waters from the OU3 capped area to be re-established into receiving waters. As a result, groundwater resources down gradient from the Ruby waste rock dump will be protected.
State of South Dakota Surface Water Quality Requirements SDCL § 34A-2-11, et seq., and implementing regulations	Applicable	The Clean Water Act, 33 U.S.C. § 1251, et seq., provides the authority for each state to adopt water quality standards (40 CFR 131) designed to protect beneficial uses of each water body and requires each state to designate uses for each water body. Pursuant to this authority and the criteria established by the South Dakota regulations, SDCL § 34A-2-11, et seq., establishes requirements for restoring and maintaining the quality of surface and groundwater.	All contaminated waters emanating from the Ruby Gulch Waste Rock Dump are intercepted and treated as part of Operable Unit 2 - Interim Water Treatment pursuant to Federal and State Clean Water Act requirements. The installation of the cap and cover will prevent further contact of precipitation with ARD-generating source materials, thereby allowing runoff of uncontaminated waters from the OU3 capped area to be re-established into receiving waters.
South Dakota Ambient Air Quality Standards ARSD § 74:36:02:02 and ARSD § 74:36:02:03	Applicable	South Dakota has adopted the federal standards for particulate (PM 10 and PM 2.5) and lead emissions. These standards apply to the entire State of South Dakota, and no person may cause these standards to be exceeded. These standards include normal background levels of air pollutants.	South Dakota has adopted the federal standards for particulate and lead emissions. Dust mitigation control measures will be implemented during construction activities.

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SUMMARY OF FEDERAL AND STATE ARARs COMPLIANCE OPERABLE UNIT 3 GILT EDGE MINE NPL SITE

Statute and Regulatory Citation	ARAR Determination	Description	Comment
FEDERAL - Location Specific			
National Historic Preservation Act (NHPA), 16 U.S.C. § 470 40 CFR 6.301(b) 36 CFR 800	Applicable	This statute and implementing regulations require federal agencies to take into account the effect of this response action upon any district, site, building, structure, or object that is included in or eligible for the Register of Historic Places.	Archeological and cultural resource surveys and inventories were completed as part of the application process by Brohm Mining Company for a State Mining Permit for the Gilt Edge Mine. Pursuant to the State mining permit the State Historical Preservation Office has granted clearance for Gilt Edge Mine area of operations as having "No Adverse Affects" on cultural resources. Remedial activities will occur within the area of operations. If any remedial action activities are necessary beyond previously permitted and inventoried areas, SHPO consultation and NHPA compliance will be addressed during remedial design.
Archaeological and Historic Preservation Act 16 U.S.C. § 469 40 CFR 6.301(c)	Applicable	This statute and implementing regulations establish requirements for the evaluation and preservation of historical and archaeological data, which may be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program.	
Historic Sites, Buildings and Antiquities Act 16 U.S.C. § 461, et seq., 40 CFR 6.310(a)	Applicable	This statute and implementing regulations require federal agencies to consider the existence and location of land marks on the National Registry of National Landmarks and to avoid undesirable impacts on such landmarks.	
Fish and Wildlife Coordination Act 16 U.S.C. §§ 1531, et seq., 40 CFR 6.302(g)	Applicable	This statute and implementing regulations require that federal agencies or federally funded projects ensure that any modification of any stream or other water body affected by any action authorized or funded by the federal agency provides for adequate protection of fish and wildlife resources.	U.S. Fish and Wildlife is actively involved in this project and have approved all planned actions as being protective of fish and wildlife resources.
Endangered Species Act, 16 U.S.C. § 1531 40 CFR 6.302(h) 50 CFR 17 and 402	Applicable	This statute and implementing regulations provide that federal activities not jeopardize the continued existence of any threatened or endangered species.	EPA has consulted with representative of the U.S. Fish and Wildlife Service and South Dakota Dept. of Game, Fish & Parks to determine the existence of federal threatened or endangered species or state species of concern within the project area. These agencies have confirmed that this action will not impact or threaten such resources.

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SUMMARY OF FEDERAL AND STATE ARARs COMPLIANCE OPERABLE UNIT 3 GILT EDGE MINE NPL SITE

Statute and Regulatory Citation	ARAR Determination	Description	Comment
Floodplain Management Regulations 40 CFR 6.302(b), and Executive Order No. 11988.	Applicable	These require that actions be taken to avoid, to the extent possible, adverse effects associated with direct or indirect development of a floodplain, or to minimize adverse impacts if no practicable alternative exists.	The Flood Insurance Rate Map prepared by the Federal Emergency Management Agency for Lawrence County, South Dakota, indicates there are no flood hazard areas in the project area.
Protection of Wetlands Regulations 40 CFR 6, Appendix A, and Executive Order No. 11990.	Applicable	This ARAR requires federal agencies and the PRPs to avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands if a practicable alternative exists. Wetlands are defined as those areas that are inundated or saturated by groundwater or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.	Based on consultations with representatives of the U.S. Fish and Wildlife Service, South Dakota Dept. of Game, Fish & Parks, and the U.S. Army Corps of Engineers, there are no wetland areas that will be affected within or adjacent to the Ruby Gulch Repository and Cap project area. However at this early phase of the project the presence and status of wetlands in the Strawberry Creek drainage is not resolved, making a finding of compliance with Wetlands Protection requirements for actions that may affect wetlands in the Strawberry Creek watershed premature.

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SUMMARY OF FEDERAL AND STATE ARARs COMPLIANCE OPERABLE UNIT 3 GILT EDGE MINE NPL SITE

Statue and Regulatory Citation	ARAR Determination	Description	Comment
Migratory Bird Treaty Act, 16 U.S.C. §§ 703, et seq.	Applicable	This requirement establishes a federal responsibility for the protection of the international migratory bird resource and requires continued consultation with the U.S. Fish and Wildlife Service during remedial design and remedial construction to ensure that the cleanup of the site does not unnecessarily impact migratory birds.	EPA's consultation requirements are being met (1) through direct participation by U.S. Fish and Wildlife Service representatives on the inter-agency site investigation and remedial action planning and management team, and (2) through continued consultation during remedial design and remedial construction.
Bald Eagle Protection Act, 16 U.S.C. §§ 668, et seq.	Applicable	This requirement establishes a federal responsibility for protection of bald and golden eagles, and requires continued consultation with the U.S. Fish and Wildlife Service during remedial design and remedial construction to ensure that any cleanup of the site does not unnecessarily adversely affect the bald and golden eagles.	
STATE OF SOUTH DAKOTA - Location Specific			
Beneficial Use of Stream Segments of South Dakota Identified ARSD § 74:51:03:02.	Applicable	This provision establishes beneficial uses for waters of South Dakota. The beneficial use classifications of surface waters established do not limit the actual use of the waters. The classifications designate the minimum quality at which the surface waters of the state are to be maintained and protected. ARSD § 74:51:03:01 defines beneficial uses of South Dakota streams to include irrigation and fish and wildlife propagation, recreation, and stock watering. All streams in South Dakota are assigned the beneficial uses of irrigation and fish and wildlife propagation, recreation, and stock watering. The classifications only designate the quality at which the waters are to be maintained and protected.	All contaminated waters emanating from the Ruby Gulch are intercepted and treated as part of Operable Unit 2 - Interim Water Treatment pursuant to Federal and State Clean Water Act requirements. The installation of the cap and cover will prevent further contact of precipitation with ARD-generating source materials, thereby allowing runoff of uncontaminated waters from the OU3 capped area to be re-established into receiving waters. The remedial design components such as revegetated cover and other water management controls will address any applicable stream discharge criteria (ie TSS/TDS).

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**SUMMARY OF FEDERAL AND STATE ARARs COMPLIANCE
OPERABLE UNIT 3
GILT EDGE MINE NPL SITE**

Statute and Regulatory Citation	ARAR Determination	Description	Comment
FEDERAL - Action Specific			
Clean Water Act Point Source Discharges Requirements 33 U.S.C. § 1342.	Relevant and Appropriate	Section 402 of the Clean Water Act, 33 U.S.C. § 1342, et seq., authorizes the issuance of permits for the "discharge" of any "pollutant." This includes stormwater discharges associated with "industrial activity." See 40 CFR 122.1 (b)(2)(iv). "Industrial activity" includes inactive mining operations that discharge stormwater contaminated by contact with, or that has come into contact with any overburden, raw material, intermediate products, finished products, byproducts, or waste products located on the site of such operations, see 40 CFR 122.26 (b)(14)(iii); landfills, land application sites, and open dumps that receive or have received any industrial wastes including those subject to regulation under Resource Conservation and Recovery Act (RCRA) Subtitle D, see 40 CFR 122.26(b)(14)(x).	<p>Because the State of South Dakota has been delegated the authority to implement the Clean Water Act, these requirements are enforced in South Dakota through the South Dakota Surface Water Discharge System (SDSWD).</p> <p>Storm water discharge best management practices will be implemented during remedial action. This capping of the waste rock dump will prevent contact of water with contaminated overburden materials.</p>

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Statute and Regulatory Citation	ARAR Determination	Description	Comment
Federal RCRA Subtitle C Requirements, 42 U.S.C. Section 9621, et seq.	Relevant and Appropriate	<p>RCRA Subtitle C and implementing regulations are designated as applicable for any hazardous wastes that are actively "generated" as part of the Gilt Edge Mine OU3 site remedial action or that were "placed" or "disposed" after 1980. Also, should hazardous wastes be discovered as part of any remedial design or remedial action.</p> <p>The State of South Dakota has been delegated authority to implement the Federal RCRA Subtitle C and D programs. The State's RCRA authorities are contained in State of South Dakota Solid Waste Requirements (SDCL § 34A-6), Hazardous Waste Requirements (SDCL § 34A-11), and Mined Land Reclamation Requirements (SDCL § 45-6B), and have been applied to the Brohm mine site through the State-issued mining permit. The substantive requirements of Brohm's permit (439 as amended) are applicable to this Superfund remedy.</p>	RCRA Subtitle C requirements assumes that there will be many solid wastes at the Gilt Edge Mine OU3 site, and that some of these may be left in place in "waste management areas" as a result of a remedial action. Because of the similarity of these waste management areas to the RCRA "waste management unit," certain discrete portions of the RCRA Subtitle C implementing regulations will be relevant and appropriate for the Gilt Edge Mine OU3 site remedial action. EPA reserves the right to identify RCRA Subtitle C requirements in more detail at a later date.

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Statute and Regulatory Citation	ARAR Determination	Description	Comment
Federal RCRA Subtitle D Solid Waste Requirements: 40 CFR 257.3-1 40 CFR 257.3-2 40 CFR 257.3-3 40 CFR 257.3-4 40 CFR 257.3-8(d)	Relevant and Appropriate	<p>40 CFR 257 establishes criteria under Subtitle D of the Resource Conservation and Recovery Act for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health or the environment. See 40 CFR 257.1(a). This part comes into play whenever there is a "disposal" of any solid or hazardous waste from a "facility." "Disposal" is defined as "the discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including groundwaters." See 40 CFR 257.2. "Facility" means "any land and appurtenances thereto used for the disposal of solid wastes."</p> <p>The State of South Dakota has been delegated authority to implement the Federal RCRA Subtitle C and D programs. The State's RCRA authorities are contained in State of South Dakota Solid Waste Requirements (SDCL § 34A-6), Hazardous Waste Requirements (SDCL § 34A-11), and Mined Land Reclamation Requirements (SDCL § 45-6B), and have been applied to the Brohm mine site through the State-issued mining permit. The substantive requirements of Brohm's permit (439 as amended) are applicable to this Superfund remedy.</p>	<p>The remedial design shall: (1) prevent washout of solid waste in facilities in a floodplain posing a hazard to human life, wildlife, or land or water resources; (2) not contribute to the taking of endangered species or the endangering of critical habitat of endangered species; (3) not cause a discharge of pollutants, dredged or fill material, into waters of the United States in violation of Sections 402 and 404 of the Clean Water Act, as amended, and shall not cause non-point source pollution, in violation of applicable legal requirements implementing an area wide or statewide water quality management plan that has been approved by the Administrator under Section 208 of the Clean Water Act, as amended; (4) not contaminate an underground source of drinking water beyond the solid waste boundary or beyond an alternative boundary specified in accordance with this section; (5) control access to a facility to prevent exposure of the public to potential health and safety hazards at the site.</p>

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Statute and Regulatory Citation	ARAR Determination	Description	Comment
Surface Mining Control and Reclamation Act 30 U.S.C. §§ 1201-1326	Relevant and Appropriate	This Act and implementing regulations, 30 CFR 784 and 30 CFR 816, establish procedures to protect the environment from the effects of surface coal mining operations, and to a lesser extent, non-coal mining operations. These requirements are relevant and appropriate to the covering of discrete areas of contamination. The regulations require that revegetation be used to stabilize soil covers of discrete areas of contamination. They also require that revegetation be done according to a plan which specifies schedules, species which are diverse and effective, planting methods, mulching techniques, irrigation, if appropriate, and appropriate soil testing.	Reclamation performance standards are being developed by consultation with U.S. Fish and Wildlife Service, NCRS, South Dakota Dept. of Game, Fish, & Parks, SD State University, and SD DENR representatives. This standards will be included in the final remedy design.
STATE OF SOUTH DAKOTA - Action Specific			
Substantive SDSWD Permit Requirements, ARSD §§ 74:52:01-11	Applicable	These provisions state that a discharge from any point source into surface waters may not occur without a valid State of South Dakota surface water discharge permit. Point sources requiring permits include industrial discharges and privately owned treatment works. Sites under CERCLA are required to meet the substantive requirements of a permit but do not have to actual obtain the permit.	All contaminated waters emanating from the Ruby Gulch are intercepted and treated as part of Operable Unit 2 - Interim Water Treatment pursuant to Federal and State Clean Water Act requirements.

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Statute and Regulatory Citation	ARAR Determination	Description	Comment
Water Quality Statutes and Regulations ARSD § 74:51:01	Applicable	A person may not discharge or cause to be discharged into surface waters of the state pollutants which cause the receiving water to fail to meet the criteria for its existing or designated beneficial use or uses. Sites under CERCLA are required to meet the substantive requirements of a permit but do not have to actual obtain the permit.	<p>All contaminated waters emanating from the Ruby Gulch are intercepted and treated as part of Operable Unit 2 - Interim Water Treatment pursuant to Federal and State Clean Water Act requirements.</p> <p>Storm water discharge best management practices will be implemented during remedial action. This capping of the waste rock dump will prevent contact of water with contaminated overburden materials.</p>
Antidegradation of Waters of the State of South Dakota ARSD § 74:51:01	Applicable	The existing beneficial uses of surface waters of the state and the level of water quality that is assigned by designated beneficial uses shall be maintained and protected and the existing and future beneficial uses of groundwater shall be maintained and protected.	
Surface Water Discharge ARSD § 74:52:01-11	Applicable	These provisions state that a discharge from any point source into surface waters may not occur without a valid State of South Dakota surface water discharge (SWD) permit. Point sources requiring permits include industrial discharges and privately owned treatment works, and stormwater associated with industrial activity. Sites under CERCLA are required to meet the substantive requirements of a permit but do not have to actual obtain the permit.	

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Statute and Regulatory Citation	ARAR Determination	Description	Comment
<p>Stat Hazardous Waste Management Requirements SDCL 34A-11 and corresponding rules ARSD § 74:28</p> <p>Surface Impoundment Closure ARSD § 74:28:25:01</p> <p>Waste Pile Closure ARSD § 74:28:25:01</p> <p>Landfill Closure ARSD § 74:28:25:01</p>	Applicable	<p>All federal RCRA Subtitle C requirements for hazardous waste treatment, storage, and disposal facilities are incorporated by reference as State of South Dakota requirements as provided for under ARSD § 74:28:25:01 unless mentioned otherwise.</p> <p>Specific requirements have been referenced back to the State Hazardous Waste requirements for surface impoundment, waste pile, and landfill closure requirements.</p> <p>Federal and State RCRA Subtitle C requirements are both relevant to this action. State Hazardous Waste requirements were deemed more appropriate since the South Dakota Hazardous Waste program is authorized.</p>	<p>Mining waste at Gilt Edge is exempt from the State Hazardous Waste Management Act and RCRA Subtitle C under the Bevill exclusion.</p> <p>However if disposal activity involves the use of a waste management unit sufficiently similar to a Hazardous Waste regulated unit, and the unit is to receive wastes sufficiently similar to a hazardous waste, the RCRA Subtitle C requirement pertaining to that type of waste management unit would be relevant and appropriate (55 FR 8763)</p> <p>Given the acid and contaminated leachate generating potential of the materials found at the Ruby Waste Rock Dump, it has been determined that the wastes are sufficiently similar to hazardous wastes to warrant imposition of selection portions of the State's Hazardous Waste Management Act (referenced back to the State Hazardous Waste requirements).</p>

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Statute and Regulatory Citation	ARAR Determination	Description	Comment
<p>State of South Dakota Solid Waste Requirements SDCL § 34A-6</p> <p>Definitions SDCL § 34A-6-1.3.</p> <p>Location Standards ARSD § 74:27:07-17</p> <p>Wildlife, Recreation, Aesthetic Value, Threatened or Endangered Species, ARSD § 74:27:11:02</p> <p>Floodplains ARSD § 74:27:11:02</p> <p>Distance to Residences, Other Buildings, Roads, and Parks ARSD § 74:27:11:05</p> <p>Distance to Surface Water ARSD § 74:27:11:06</p> <p>Wetlands ARSD § 74:27:11:07</p> <p>Gravel Pits and Quarries ARSD § 74:27:11:08:01</p>	Applicable	<p>Sets forth standards that all solid waste disposal sites must meet. These requirements apply to any person involved in any aspect of the management of solid waste, including recycling, processing, transporting, storing, or disposing of solid waste.</p> <p>Rubble sites, construction demolition sites, restricted-use sites, nonmunicipal solid waste monofills, and other types of facilities not specifically listed must be designed and constructed to protect human health and prevent degradation of the environment, including ambient groundwater quality, surface water quality, and air quality.</p>	<p>The definition of mining waste includes “waste rock, rubble or tailings produced as a result of mining or ore processing operations”. The definition for solid waste specifically excludes mining waste as a solid waste. Specific components of these regulations will be relevant and appropriate to the proposed actions.</p> <p>The remedial design facility shall: (1) not cause significant adverse effect to wildlife, recreation, aesthetic value of an area, or state and federal threatened or endangered species; (2) not be located within the boundaries of a 100-year floodplain; (3) not be located within 1,000 feet of an occupied dwelling, school, hospital, interstate or primary highway right-of-way, or public park or recreation area. The location may not pose a potential safety hazard to the public; (4) dispose of materials that may pollute surface water may not be located within 1,000 feet of streams, creeks, lakes, reservoirs, or other bodies of water classified for fish life propagation defined by chapters 74:03:02 to 74:03:04, inclusive; (5) not be located in wetlands; and (6) be free of regulated asbestos-containing waste materials, asphalt-containing materials, petroleum products, or other materials that may pollute groundwater may be disposed of in gravel pits or quarries. Facilities may not be located in an unstable area.</p>

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SUMMARY OF FEDERAL AND STATE ARARs COMPLIANCE OPERABLE UNIT 3 GILT EDGE MINE NPL SITE

Statute and Regulatory Citation	ARAR Determination	Description	Comment
<p>State of South Dakota Solid Waste Requirements SDCL § 34A-6</p> <p>Facility Design and Construction ARSD § 74:27:12</p> <p>Site Characterization ARSD § 74:27:12:03, :04, and 05</p> <p>All-Weather Roads and Fills Areas ARSD § 74:27:12:05</p> <p>Public Access Controls ARSD § 74:27:12:09</p> <p>Surface Water Control ARSD § 74:27:12:16.</p> <p>Final Cover ARSD § 74:27:12:21</p> <p>Construction ARSD § 74:27:12:22 and ARSD § 74:27:12:23</p>	Applicable	<p>Rubble sites, construction demolition sites, restricted-use sites, nonmunicipal solid waste monofills, and other types of facilities not specifically listed must be designed and constructed to protect human health and prevent degradation of the environment, including ambient groundwater quality, surface water quality, and air quality.</p> <p>A construction quality assurance plan shall be prepared that addresses all aspects of facility construction. In addition, notification shall be provided to the State of South Dakota at least 30 days before the expected initiation of construction. "As built" drawings of the facility shall be maintained by the operator of the facility.</p> <p>EPA has determined that the State has a solid waste program in place that meets federal requirements, therefore the state requirements for solid waste are appropriate.</p>	<p>A site characterization have been preformed to determine soil properties and a hydrogeologic evaluation.</p> <p>The remedial design will: (1) be accessible by an all-weather access road and must have all-weather onsite roads suitable for travel by loaded vehicles;(2) control public access through the use of fences, gates with locks, and similar controls.; (3) divert normal surface water flow and stormwater runoff around or away from areas where waste is present and from other operational areas. Surface water drainage and control systems must be designed to minimize mixing of stormwater with leachate and to handle the peak flow from a 25-year, 24-hour storm; (4) have a minimum of 18 inches of compacted soil material and 6 inches of topsoil placed over landfill units.</p> <p>The compacted soil layer will have a permeability of 1 x 10⁻⁶ centimeter per sec (cm/sec) or less. The final surface gradient of the unit will have at least 2 percent to prevent ponding. The vegetative cover must be seeded and established in accordance with the South Dakota Field Office Technical Guide, Section IV-A, Plant Sciences, (September 26, 1984), Critical Area Planting, and in consultation with the local soil conservation district office personnel.</p> <p>Other facilities must install a minimum of 2 feet of earthen material capable of maintaining perennial vegetation.</p>

APPENDIX A

SUMMARY OF FEDERAL AND STATE ARARs COMPLIANCE OPERABLE UNIT 3 GILT EDGE MINE NPL SITE

Statue and Regulatory Citation	ARAR Determination	Description	Comment
<p>State of South Dakota Solid Waste Requirements SDCL § 34A-6</p> <p>Closure and Postclosure ARSD § 74:27:15</p>	Applicable	<p>This provision establishes standards by which nonmunicipal solid waste monofills and other types of facilities must be closed and perform postclosure care activities to ensure that the closure of the facility and of each landfill unit of the facility meet the performance standards. Nonmunicipal solid waste monofills and other types of facilities not specifically listed must comply with the applicable provisions of ARSD §§ 74:27:15:02 to 74:27:15:11, inclusive. These provisions also require the development and implementation of a closure plan, notification on the deed of the property that the land has been used as a solid waste facility, development and implementation of a postclosure plan.</p>	EPA and SD DENR will develop a postclosure plan for the Ruby Cap and Repository. EPA is required to perform a 5-year review for all remedies where waste is left in place to assure that human health and the environment are protected.
<p>South Dakota Mined Land Reclamation Act SDCL 45-6B, and ARSD Article 74:29</p>	Applicable	<p>This act sets forth standards by which mine operators are to conduct reclamation of all affected lands. Certain discrete portions of the statutory or regulatory provisions are relevant and appropriate requirements.</p> <p>The definition of reclamation is the employment during and after a mining operation of procedures to minimize the disruption from the mining operation and to provide for the rehabilitation of the affected land through the rehabilitation of plant cover, soil stability, water resources, or other measures appropriate to the subsequent beneficial use of the mined and reclaimed lands.</p>	EPA's consultation with SD DENR during remedial design development will have satisfied this requirement.

APPENDIX A

SUMMARY OF FEDERAL AND STATE ARARs COMPLIANCE
OPERABLE UNIT 3
GILT EDGE MINE NPL SITE

Statue and Regulatory Citation	ARAR Determination	Description	Comment
Noxious Weeds ARSD § 12:62:03, et seq.	Applicable	ARSD § 12:62:03:01.06 lists weeds which are declared to be noxious statewide. A locally noxious weed is defined as any weed that is biennial, perennial, or a pernicious annual, capable of spreading rapidly, not controllable without special preventive chemical, mechanical, biological, and cultural practices, capable of materially reducing the production of crops or livestock, and capable of decreasing the value of the land. ARSD § 12:62:03:01.07 lists weeds that may be declared locally noxious.	A revegetation plan is being developed by EPA with consultation from U.S. Fish and Wildlife Service, USDA National Resource Conservation Service (with local and county coordination), South Dakota Dept. of Game, Fish, & Parks, SD State University, and SD DENR representatives. The revegetation plan will be included in the final remedy design.